NOORA
PIHLAJARINNE

BEYOND THE Peaks

How to support creativity by learning environment architecture

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How to support creativity by
learning environment
architecture

Tampere University of Technology
School of Architecture

Noora Pihlajarinne

Beyond the Peaks
How to support Creativity by Learning Environment Architecture
Master's Thesis

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TAMPEREEN TEKNILLINEN YLIOPISTO
TAMPERE UNIVERSITY OF TECHNOLOGY

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BEYOND THE PEAKS
- HOW TO SUPPORT CREATIVITY BY LEARNING ENVIRONMENT ARCHITECTURE

Master's Thesis

Examiner: Professor Ilmari Lahdelma
Examiner and topic approved by the Faculty Council of the Faculty of Business and Built Environment on 8 November 2013.

Abstract

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This thesis investigates solutions for increasing creativity and innovation by university environment design. New learning methods emphasize the importance of creative, student-directed problem solving in effective learning. Creativity and innovations are seen as key drivers of the economy based in knowledge, and universities as responsible for the highest education of tomorrow's creative experts. Often, top universities are already direct sources of commercial innovations and act as an important engine for the economic growth of their regions. Taking creativity into account in university learning environment design can therefore be considered as a valuable research subject.

Despite the actuality and importance of the subject, systematic scientific research on the relation between creativity and physical environment is scarce. This thesis approaches the subject from the viewpoint of creativity itself by examining key factors that have been found to initiate creativity. From this base, the study suggests a design concept that aims at supporting these factors. Last, the study presents a design example where the concept is examined to the level of design solutions.

As a study of architecture, creativity is examined through the factors that physical environment is likely to have significant impact on. The taken framework sets creativity in a wider context of space types, functions, and space organization rather than that of a single room or workplace design. The impact of mere architectural style on creativity is studied only indirectly and through the author's presumptions.

The study is made as a part of a research project "Spaces for learning and creation of new knowledge" (RYM-SHOK Work package 4), of which University Properties of Finland Ltd, acts as the driver company. The design solution presented at the end of this study is based on a project for Architectural Design Advanced course in TUT's Department of Architecture in the spring of 2013. The exceptional extent of this project made it possible to develop it further and include it as a part of this Master's Thesis.

Tiivistelmä

TAMPEREEN TEKNILLINEN YLIOPISTO
Arkkitehtuurin koulutusohjelma

Pihlajarinne, Noora: Beyond The Peaks - How to support Creativity by Learning Environment Architecture

Diplomityö, 179 sivua, tammikuu 2014
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Avainsanat: Oppimisympäristön suunnittelu, Yliopistojen suunnittelu, Arkkitehtuuri, Suunnittelu, Oppimisympäristö, Luovuus, Innovaatiot

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Tämä diplomityö tutkii, miten luovuutta ja innovatiivisuutta voitaisiin edistää yliopistoympäristön arkkitehtuurin keinoin. Pedagogiikan nykysuuntaukset korostavat luovan, opiskelijalähtöisen ongelmanratkaisun tärkeyttä tehokkaassa oppimisessa. Luovuus ja innovaatiot voidaan nähdä tietoyhteiskunnan tärkeimpinä tuotantomenetelminä, ja yliopistot vastuussa tulevaisuuden luovien osaajien korkeakoulutuksesta. Maailman menestyneimmät yliopistot ovat jo nyt usein suoria kaupallisten innovaatioiden tuottajia ja tärkeitä lähialueidensa talouskasvun moottoreita. Luovuuden myötävaikuttamista yliopistoympäristöjen suunnittelun keinoin voidaan näin pitää arvokkaana tutkimuskohteena.

Huolimatta aiheen ajankohtaisuudesta ja tärkeydestä on systemaattista tutkimusta fyysisen ympäristön ja luovuuden suhteesta tehty hyvin vähän. Tämä diplomityö lähestyy siksi aihetta luovuudesta itsestään käsin. Tutkielma etsii luovuutta keskeisesti edistäviä tekijöitä poikkitieteellisestä viitekehyksestä käsin, ja esittää tekijän näkemyksen suunnittelukonseptista, jonka avulla näitä tekijöitä voitaisiin tukea arkkitehtisuunnittelun keinoin. Lopuksi tutkielma esittää konseptin käytännön sovellusmahdollisuuksia esimerkinomaisen suunnitelmatyön muodossa.

Koska kyseessä on arkkitehtuurin tutkimus, tutkielma keskittyy tarkastelemaan luovuutta niiden ominaisuuksien osalta, joihin ympäristön vaikutuksen voidaan katsoa olevan merkittävä. Laajuuden rajaamiseksi aihetta on käsitelty lähinnä tilatyyppien, toimintojen ja tilojen sijoittumisen kannalta. Yksittäisen tilan ominaisuuksien perusteellinen tutkiminen on jätetty pois tarkastelusta. Samoin muotokielen vaikutuksen pohdinta rajoittuu lähinnä tekijän omien olettamusten varaan.

Tutkimus on tehty osana “Oppimisen ja uuden tiedon luomisen tilat” (RYM-SHOK, työpaketti 4) -tutkimushanketta, jonka veturiyrityksenä toimii Suomen Yliopistokiinteistöt Oy. Työn lopussa esitetty suunnitelma pohjautuu TTY:n arkkitehtuurin laitoksella Rakennussuunnittelun jatkokurssilla (kevät 2013) tehtyyn harjoitustyöhön. Työ on ollut mahdollista jatkokehittäen liittää osaksi tätä diplomityötä sen tavanomaista laajemman sisällön vuoksi.

TERMS

Creativity:
The Oxford English dictionary defines creativity as ”The use of imagination or original ideas to create something; inventiveness”. This can be complemented with John Haefele’s definition (1962 p. 272): “The ability to form new combinations to solve difficult problems”.

Innovation:
Hennessey and Amabile (2010, p.585) define innovation as “the successful implementation of creative ideas”. This study sees innovation as a further cultivated product of creative thinking, even though the word is often used also as a synonym for a creative idea.

Space:
A three-dimensional area that is used or available for a specific purpose (Merriam-Webster dictionary 2013).

Environment:
The physical surroundings in which a person lives or operates (Oxford English Dictionary 2013). The three-dimensional combination of spaces that accommodate multiple functions and of their relationships.

Divergent thinking:
Spontaneous, free-flowing thinking with the goal of generating many different ideas in a short period (Hennessey & Amabile 2010, p.574).

Association:
A mental connection between things (Oxford English Dictionary 2013). Divergent associations form the basis for divergent thinking theory (Mednick 1962)

Convergent thinking:
Disciplined thinking, focused on narrowing possibilities to a workable solution (Hennessey & Amabile 2010, p.579). Often assimilated to logical or analytical thinking.

Extrinsic motivation:
A driver of behaviour deriving from external rewards such as money, fame, grades, or praise (Hennessey & Amabile 2010 p.581).

Intrinsic motivation:
The drive to engage in a task because it is interesting, enjoyable, or positively challenging (Hennessey & Amabile 2010, p.574). The inborn desire to act.

Trigger object / stimulus:
An object (e.g. a person or idea) that evokes inspiration in individual and results in empowering intrinsic motivation (Thrash & Elliot 2003 p.871).

Inspiration:
Inhaling an idea, purpose etc. into the mind that results in creation of a feeling or impulse and an elevated state of mind. (Thrash & Elliot 2003 p.871). This study sees inspiration as any element that evokes intrinsic motivation with an energizing influence.

“

IT IS EASIER TO
CREATIVITY BY
CONDITIONS IN
ENVIRONMENT

than by trying to make p
think more creatively”

ENHANCE
CHANGING
THE

eople

Mihaly
Csikszentmihalyi
1996 p.1

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1 INTRODUCTION | *Background &*

Why should learning environment design aim at supporting creativity in the first place? This chapter enlightens the background of the chosen approach. The subject is introduced through the trends of pedagogics, changes in economics and examples of the top universities of the world.

When we are creative, we feel we are performing at the peak of our abilities. Creativity is a captivating sensation that engages us to work and gives us great satisfaction. Artists', writers' and scientists' passionate orientation to work is a living proof of creativity's effect on work motivation.

Creativity and innovation seem to have become trend expressions, desired characters everywhere by education, companies, cities and countries. Designing "creative spaces" is a feverish issue in architecture and interior design. A range of traditional work environments have been renovated into "creative" ones with unconventional furniture, colourful wallpapers and new technology. However, scientific research on the ways that physical environment can actually promote creativity and innovation seems to be missing.

This study plays a part in trying to find accurate design principles that can influence creativity. Its aim is to discover main features that modern science sees as the initiators of creativity, and to form a concept on how they can be taken into account and supported in architectural design.

This chapter sets the beginning to this study by introducing how it is conducted and then by enlightening the background and reasons for the chosen subject.

CONSTRUCTION
of the study

The study starts up by presenting the main reasons and backgrounds for the chosen subject in chapter 1. Chapters 2 and 3 together introduce the theoretical framework. It is conducted by a literature review based mostly on psychological and sociological studies, which seem to provide the most systematic approach to the subject so far. These two chapters outline the main features that modern science sees essential in fostering creativity and innovation.

From this theoretical framework, chapters 4 and 5 form a vision on how architectural design could be used to support these previously discovered features. Chapter 4 introduces my proposition of a design concept that is based on five design principles. Last, chapter 5 shows an example of how the introduced concept could be converted to a visible form of university building design.

THEORETICAL FRAMEWORK

CREATIVE PROCESS

DIVERGENT THINKING

INSPIRATION

MOTIVATION

POSITIVE EMOTION

1 Chapter

Backgrounds & Introduction

Why should learning environment architecture aim at fostering creativity?

2 Chapter

Creativity Components

What is Creativity made of? Chapter 2 presents features that are related to Creativity of individuals

EMOTIONAL ENERGY

INTELLIGENT NETWORKS

TALENT

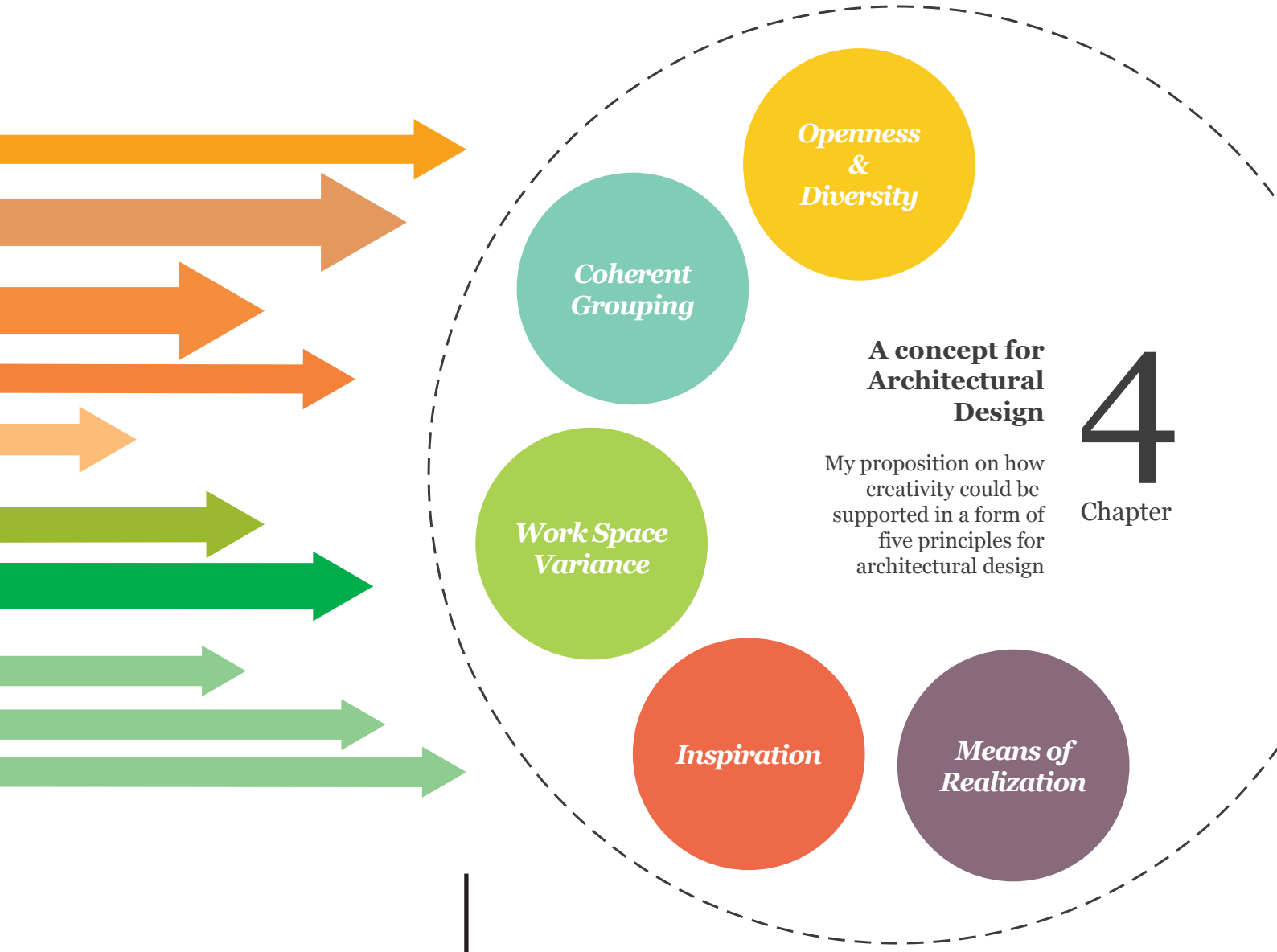
TOLERANCE

TECHNOLOGY

3 Chapter

The role of place & Creative Community

The role of community in nourishing Creativity and its requirements on physical place.



A concept for Architectural Design

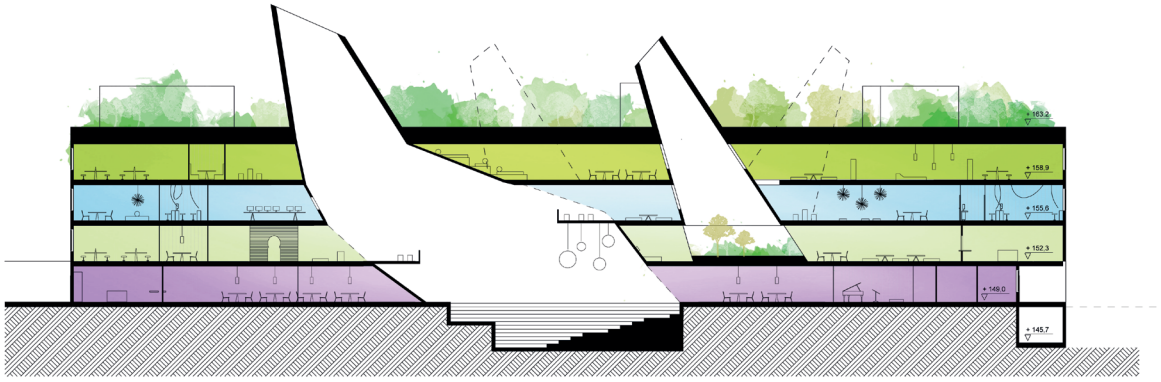
My proposition on how creativity could be supported in a form of five principles for architectural design

4 Chapter

5 Chapter

PIM! a Design application

My design example showing the above formed concept turned into an architectural solution



1.1
TOWARDS **EFFECTIVE** LEARNING

In the early times of the establishment of a university system the main mission of teaching was the effective transference of information from teachers to students. Nowadays however, we have an easy access to almost any kind of information through books and internet, so learning can, and should mean more than just pure transmission of information.

A review made by Finnish university learning experts Lindblom-Ylänne & Nevgi (2009) about the history of learning theories is interesting. They succeed in demonstrating that the learning methods where student's role remains just a passive receiver of information are the most inefficient. This kind of learning does not seem to result in qualified learning outcomes. In a passive learning situation, students don't have the opportunity to actively build knowledge, and so they remain unable to direct their own learning and set personal goals (Lindblom-Ylänne & Nevgi 2009 p. 202).

"Swallowing packaged information as a whole in lectures" is a method that is clearly outdated, but still commonly in use. Lindblom-Ylänne and Nevgi state that the basis of this is found from strong traditions of behaviourism. Behaviourism was an approach of psychology that emphasized the role of behaviour and classical conditioning but let deeper mind processes unconsidered. Although behaviourism was replaced by further developed approaches already in the 1950's, its influence remains deep.

Cognitive approach, on its turn, took mental processes as its target. According to cognitive didactics effective learning requires learner's conscious orientation to the subject. ***Motivation*** is the key to effective learning and academic success. When learning is driven by ***personal interest*** and ***individual potential*** learners are likely to engage to their cognitive processes. (Lindblom-Ylänne & Nevgi 2009.)

A current trend in education seems to be the transition from traditional methods of transmitting ready-made information into an ***active*** learning model. In active learning, the interest rises from students themselves and then guides them towards a problem-based and research driven learning. The problems that are meaningful for one's own interests generate a desire to learn. They also help to realize the importance of learning and research. (Lindblom-Ylänne & Nevgi 2009.)

In conclusion, learning seems to be more effective when the knowledge is not given but *constructed*. ***Constructive learning method*** emphasizes insightful learning and results in an inventive and creative learning process. The learner investigates, experiments and seeks answers. The role of the teacher is seen to support learners and mentor them by helping to find meaningful questions rather than giving straight answers. Method can be seen advantageous especially in university teaching since it provokes student's own reflection, creation of new ideas and develops scientific thinking abilities. (Lindblom-Ylänne & Nevgi, 2009 p.222.)

CREATIVITY *based learning*

Learning, scientific research and creativity have a lot in common. They all are at their best when driven by personal interest, curiosity and wondering. Scientific research is about creating new knowledge, whereas learning can also be understood as a struggle to understand certain phenomena and to uncover new information. It seems however that there is still a strong separation between learning and research in Finnish universities; research is conducted by researchers and students are mainly taking their basic studies to accomplish their degree. Yet since the purpose of science, and that of universities, is to reveal new knowledge, why are the students not actively taken into research also? How could we combine learning and research?

Scientific research is obviously made with creative imagination. Galileo's theory of motion, Darwin's theory of natural selection or Einstein's theory of relativity are examples of creative achievements of science. Dr. John Haefele, who has accomplishments on both scientific research on chemistry and novel writing describes the relation between creativity and research as follows: "the scientist is as attached to his discovery as any artist to his painting or author to his book; a creative inventor finds deep satisfaction - and deep ego involvement - in aesthetic beauty of his creation or discovery." (Haefele 1962 p. 24). The ***enjoyment of discovery*** is extremely captivating and apt to evoke ***engagement*** and ***motivation***.

Equally, ***learning*** can be seen as creative work on its fundamentals, even though the invention comes from a discovery that someone has already done before. The discovery is *new for the learner,* it motivates him and brings a great feeling of enjoyment and fulfilment. Creative learning resembles thus making an innovation.

Creativity based learning has a growing ***interest worldwide***. However, Hennessey & Amabile (2010) indicate a striking contrast in its research in the west and other parts of the world. Singapore, for instance, has made the fostering of creativity in schools a top priority since more than 20 years ago. Especially in Asia there is a virtual explosion of interest in creativity in schools, whereas in Europe the subject remains still quite unfamiliar to general knowledge. (Hennessey & Amabile 2010.)

Kettunen et al. (2013) have been ones to actively develop creativity based learning in Finland. They have developed a specific learning method called "innovation pedagogy", which emphasizes the role of high education as a strong part of innovation networks and regional competence. Kettunen et al. claim that innovation pedagogy improves the correspondence between education and the later needs of working life. The desired outcome is to develop the innovation competencies of the students so that they can be used in their future jobs. (Kettunen et al. 2013.)

> *"Learning is **creative work** on its fundamentals*

The changed economic climate has made ***ideas*** *more valuable to us than any physical property, and creative workers our* ***new means of production***.

“

1.2

INFLUENCE OF **ECONOMICS**

Globalization and increased well-being in western countries is reshaping our society. As economic point of view, this means that as most of the manufacturing and heavy industry is moving to countries with low manufacturing costs, Western countries are undergoing a big transition to an economy driven by knowledge. This means that success of nations in global competition will be mainly depended on how well the capacity to produce new knowledge is used. This sets new demands on our economic strategies and productional structures. Richard Florida, an American theorist of economic geography, has been one of the strong actors to show that creativity, new ideas and innovations must now be seen as the means to survive in this new situation and as our most valuable economic resources (Florida 2012).

New ideas and innovations are discovered by creative talent. Florida has become well-known for defining a ***Creative Class***, a socio-economic class whose members are responsible to drive the new economic development. By his words, Creative Class is formed out of people who are engaged to creative work regularly, and compose the most of the creative professionals of the society. Florida defines them as scientists and engineers, university professors, poets and novelists, artists, entertainers, actors, designers and architects. Their primary job is to create transferable, widely usable new forms, and to define and solve intellectual problems. (Florida 2012 p.38-39).

Florida claims aptly that ideas have now become more valuable to us than any kind of physical property and creative workers of the Creative Class our new means of production. It's inevitable that the transition to knowledge economy raises the importance of production of new knowledge for economic growth and global competitively. Even though it may seem abrupt to categorize special class to lead economic development, it should be at least expected that the demands of future labor markets will focus increasingly on creative skills of employees.

1.3

UNIVERSITIES AS A SOURCE OF CREATIVITY

If we believe that creativity is the answer to global competence, we have to start making quick actions to invest in it. Florida puts it as follows: "Just as we once sank vast amounts of public and private funds into canals, railroads, highways and other physical infrastructure to power industrial growth, the country today needs to massively increase its investments in its human creative capital" (Florida 2012 p.390). However, as a small nation, Finland's economic possibilities to invest in innovations are modest. Pekka Himanen (2010) has studied the post-industrialist paradigm. He points out insightfully that if we are aiming to reach global competence, the demand is that the resources are focused on units where innovation potential is high and where these modest resources are sufficient to reach a global peak (Himanen 2010).

Universities can be many ways seen as profitable target for this investment. By definition, they are producers of prominent new knowledge that aim to national development. Even for this reason only, we can estimate that the change into knowledge-intense society and knowledge-driven market competition increases the role of universities even more.

> *"The high-quality education system forms a base for the whole economy since it* ***impacts directly*** *on how qualified researchers and employees there are in the future.*

> *Current campus environments have been designed to serve traditional education paradigms*

Universities have already proven to be successful incubators of creativity. Top universities are often direct generators of commercial innovations. “MIT, Stanford, Berkeley and Carnegie Mellon belong in an elite list of about a dozen universities that do a truly professional job of consistently bringing university-led innovation to market” Florida (2012) writes. Many commercial success stories such as Hewlett-Packard (Stanford), Apple (Stanford, “Apple garage”) are born in cooperation of highly creative university students.

Universities are also key elements in promoting regional economic growth; most of the world’s leading innovation centers have formed around top universities. For example Stanford University is the creative nucleus of the Silicon Valley, as the MIT is for high-tech scene of Boston. (Florida 2012 p.310). As a national example, the establishment of Oulu University has had a huge impact on the economic development of whole northern Finland in the 1970’s.

Universities form the basis for whole future economy as they are responsible for the high education of future professionals. The quality of high education impacts directly on how qualified researchers and business employees there are in the future, and so how qualified our input to markets can be. Education can be compared to a kind of industry; as a production of knowledge and skills for predetermined purposes and markets. Teaching and learning are steered by the principles of economy; industrial economy raised rationalism and efficiency as the key drivers for educational improvement. (Florida 2012.) Intelligence is still seen as a feature dominated by ”the right answer” and evaluated by test scores, rather than as a broader creative talent. If we want to uplift the creative skills of the future professionals, we need a significant change of view in this educational paradigm.

Current campus environments speak the same language with the educational outlooks. Most of them have been designed to serve traditional education paradigms and are now facing a mismatch with modern learning objectives. In order to cultivate creativity in universities we need a total change of approach in campus design as well. Architectural research on the subject is still scarce and developing but gives some directions. For example Jankowska & Atlay (2008) have conducted research on the effect that a specially designed, creative learning space can have on students’ engagement with the learning process, their motivation, and learning independence. Initial results of this research indicate increased outcomes in student’s creativity, problem solving and various thinking skills compared to the learning in a traditional learning environment. (Jankowska & Atlay 2008.)

> *In order to cultivate creativity in universities we need a* ***total change of approach*** *in campus design as well*

Image: Creative Commons

Creativity

Inspiration

Trigger stimulus

Energizing

Enables

Intrinsic Motivation

Inborn

Good for

Extrinsic Motivation

External reward

Bad for

Promotes

Positive affect

Feeling of safety

Expanses thinking

Social interaction

Promotes

Divergent thinking

Free flowing

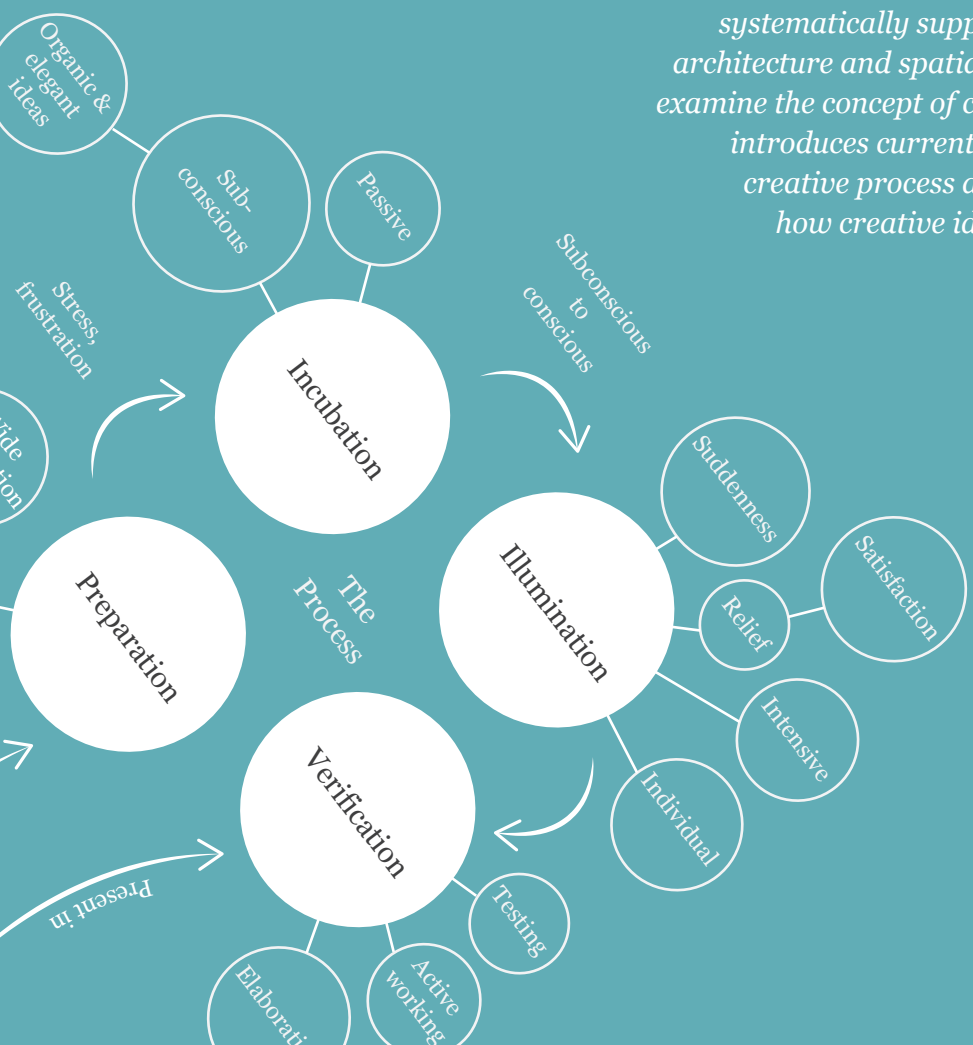
Connecting unexpected thoughts

Collecting material

Components of CREATIVITY

2

What is creativity made of? In order to start systematically supporting creativity in campus architecture and spatial design, we have to further examine the concept of creativity itself. This chapter introduces current scientific understanding on creative process and the main mechanisms of how creative ideas are formed in the mind.



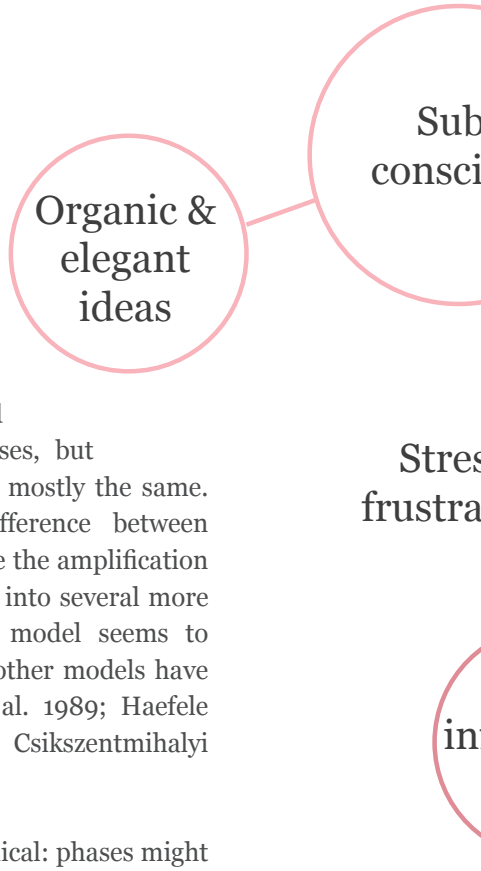
The aim of fostering creativity includes a presumption that creativity can be somehow controlled. For a long time, creativity has had a reputation of deriving from mysterious sources and being a gift of few selected geniuses. Needless to say, this outdated illusion is false. There is a great quantity of systematic research published on creativity. Analyses of great creators of our time, poets, novelists, mathematicians and artists been made through their notebooks, letters and biographies. Psychologists have been studying creativity for decades; theories have been formed and experimental tests carried out. Recently the new means of brain imaging technology has brought knowledge on how creativity is formed in the brain. Today, creativity is seen as a logical, although complicated process that can be understood, investigated and harnessed into a resource. This knowledge base forms a wide theoretical framework.

Creativity is formed by various factors; by creative process, personal characteristics and abilities, brain structure and situation to name a few. This study focuses on viewpoints that have a relation to the physical environment and its design. Therefore, for example, the important topic of characteristics of a creative personality is left out of discussion. This chapter presents the basic features of creativity that arise repeatedly from the body of literature, restricted to subjects that architectural design is likely to have an impact on.

2.1 CREATIVE **PROCESS**

The research history of creative process seems to be a long one. First investigated through experiences of creative individuals, it was noticed that the birth of a creative idea seemed to follow the same pattern. Here, I will use the following four-phased creative process model as proposed first by psychologist Graham Wallas in 1926:

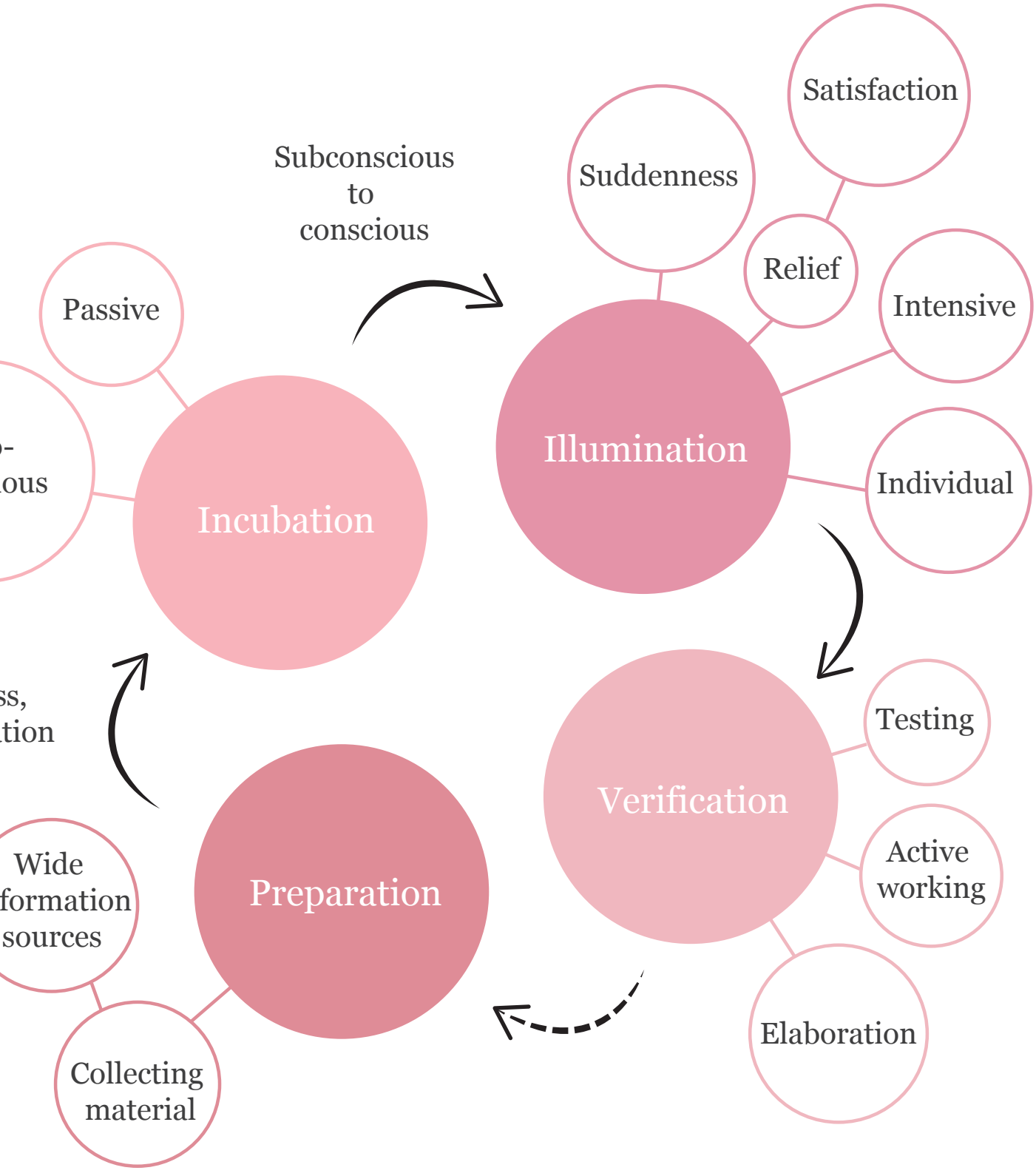
1. **Preparation**
2. **Incubation**
3. **Illumination (Insight)**
4. **Verification**



Between different theories there are variance in number and composition of the phases, but the overall content stays mostly the same. The most common difference between compositions seems to be the amplification of the preparation phase into several more specific levels. Wallas's model seems to include all the contents other models have (for example Glover et al. 1989; Haefele 1962; Nyström 1979, Csikszentmihalyi 1996).

The process model is cyclical: phases might repeat in different scales until the creative idea is born. It is also time-scalable; some creative processes achieve results in 5 minutes whereas others take several decades to complete.

To see how architectural design could support the varying natures of these four phases, I will next shortly introduce their main characteristics.


Subconscious
to
conscious
Satisfaction
Suddenness
Relief
Intensive
Illumination
Individual
Passive
Incubation
Testing
Verification
Active
working
Elaboration
Wide
formation
sources
Preparation
Collecting
material

2.1.1
PREPARATION

Preparation phase is about familiarizing oneself with the creative problem at hand: ***assembling the core knowledge*** and tools essential to problem solving and mental orienting. As industrial designer George Nelson puts it: "creative people do not just walk around and have ideas. The ideas are a result of a considerable amount of delving into the problem" (Quoted by Glover et al. 1989 p.178).

The main operations of preparation are defined as restating the problem, collecting material from a wide variety of sources and deciding directions to which material must be developed. The selected material is then manipulated actively in the brain by using different mental techniques such as "restructuring, symbolization, and developing analogies, struggling with the material and conscious thinking to find the solution" (Haefele 1962 p.28). The nature of work in preparation phase is ***systematical***, and requires easy access to a wide scope of ***sources of information***.

2.1.2
INCUBATION

There are a lot of writings on ideas which were born when least expected, while thinking something else completely. This can be explained by ***incubation***. Incubation is a very important phase between preparation and insight. In point of fact, it might even be described as the most important period in the whole creative process.

Wallas describes incubation as characterized by free working of the ***subconscious*** of the mind (after Glover et al. 1989 p.179). Thrash and Elliot (2003) report that the subconscious is generally kept as a producer of ideas that are more ***organic*** and ***elegant*** than those manufactured by the conscious mind. Also Freud has pointed

that consciousness itself is not capable of producing things of beauty, truth and harmony, but needs subconscious by its side (after Haefele 1962 p. 73). During incubation the subconscious seems to mix up the collected substance with subconscious material; memories, emotions and peripheral and unconscious observations. "Interconnected network of flexibly arranged knowledge acquired during the preparation stage is being restructured into new schemata, that is, elements of the original representation are being recombined and reordered to create new mental structures" (Glover et al. 1989 p.179).

Moving from preparation to incubation is rarely a result of conscious determination. Commonly it seems to be a result from ***frustration***; when even a great quantity of preparative material is not leading to a solution, the inventor becomes anxious. Haefele successfully puts the turning moment into words:

> *"From the failure to solve the problem come fatigue and frustration and the inventor finally gives up inventing. Then, when the* ***conscious turns to other things****, the unconscious is ready to take the lead, and the real incubation phase can start. As with an unresolved psychic conflict, the organized body of preparative material, plus frustration, are pushed* ***into the subconscious****"*
>
> (Haefele 1962 p.23)

It seems thus that starting the important phase of incubation, subconscious needs both the ***means*** (material collected in preparative phase) and the sufficient ***motive*** (frustration) to continue action. The desire to relieve the frustration acts as a powerful motive for the subconscious to involve in the process. Haefele (1962) thus reminds that a temporary let-down, a discouraged feeling can be a significant factor in finding the correct answer to the problem.

The incubation phase could be describes as seemingly ***passive*** in its nature and as something that may show up as ineffective waste of time or even as laziness for its practitioner's part. It is anyhow ***crucial*** to the creative process and too early conscious attempts to guide and control it are usually doomed to failure (Glover et al. 1989 p. 179).

SUBCONSCIOUS
is generally kept as a producer of ideas that are more **ORGANIC AND ELEGANT** *than those manufactured by the conscious mind.*

2.1.3 ILLUMINATION (INSIGHT)

Incubation ends at attaining the high moment of insight, a common sensation to anyone who has ever invented something. Illumination is also called the “Aha!” experience. After the period of subconscious incubation, the exhilaration of insight strikes seemingly out of nowhere, often with dramatic ***suddenness***.

Insight could be described as a shift from situation where all the facts were in confusion into an sudden order where essential points are clearly seen. “What has previously been subconscious suddenly becomes fully conscious” Glover et al. (1989 p.179) describe. Ideas of associated material, conclusions, and methods of verification and development are flooding from subconscious to conscious mind (Haefele 1962). Illumination is often the most visible sign of creative work, and may be one possible explanation for its mystical reputation.

Now that the problem has returned to the conscious, it starts working the idea feverishly to set all its pieces in place. A strong ***conscious effort*** is made to realize the meaning of all the pieces of ideas that flood in. The work just after illumination is often ***intensive*** and ***individual***, and any disturbance distresses the inventor. Illumination often includes a strong feeling that the idea has to be assembled right away in its clearness, or it will vanish. (Haefele 1962.)

Illumination can be said to be the actual birth of the creative idea. Insight is a strong source of ***enjoyment***, and usually the most ***rewarding*** point in creative behaviour; it gives its inventor an extreme feeling of success. This may be one of the reasons why creative work is so motivating. Haefele (1962) points out interesting relation with our most common sources of quotidian pleasure and the enjoyment of insight. Reading, watching a play, opera or movie or playing games (e.g chess, poker) are all fundamentally based on insights. For example, following a detective story makes the reader repeat the insights of the imaginative character, the detective, which makes reading crime novels so amusing. (Haefele 1962.)

2.1.4
VERIFICATION

Some ideas may end at the illumination phase. However, often the ideas do not develop fully in the illumination, but form conclusive yet incomplete answers. After the illumination, the inventor must estimate wether the idea that insight has brought is valuable and worth pursuing. If so, the elaboration phase can start.

Verification means that the idea is ***actively worked*** in order to obtain the form of mental image that was brought by illumination. Verification includes expanding and reforming the idea, with several detailing decisions and active work, but finally ***completes*** the idea. (Glover et al 1989; Haefele 1962)

While insight is a pure product of subconscious mind, the verification seems quite the opposite. It is specific in its nature, and concerned with ***physical matters*** such as numbers and a lot of ***experimental testing***. (Haefele 1962.) Verification is the time of elaboration and revision, and public evaluation and group work could be considered helpful, maybe even crucial.

2.2 DIVERGENT **THINKING**

Many occasions, creativity is described as a successful combining of unexpected things. Divergent thinking is a term used for describing this certain way of mental activity. It is the way our brain produces ***new connections*** between distant things. It has said to be about taking a different direction from the usual modes of thought or expressions (Heilman et al 2003). Divergent thinking links unconventional thoughts from different parts of the brain and is therefore more likely to breed new ideas than convergent thinking, which is disciplined, analytical and straightforward.

Divergent thinking is therefore many times acknowledged as the ***main mental operation*** in creative behaviour. Dr. Sarnoff Mednick (1962) was the first to formulate "The Associative theory of the Creative Process". In his study from 1962, he defines creative thinking as "forming associative elements into new combinations which either meet specified requirements or are in some way useful" (Mednick 1962 p.221). Creative thinking can so be seen as succeeded synthesizing, a "combinatory play" as described by Einstein.

Divergent thinking

Spontaneous, free-flowing thinking with the goal of generating many different ideas in a short period

Association

A mental connection between things

Fluency is a term that appears often in creativity literature. It means that the ability to produce a *large number* of ideas increases the likelihood to have *significant ideas* (i.a Glover et al. 1989). By terms of Mednick's (1962) theory, an ability to develop a ***large number of associations*** to a problem results in greater probability of original solutions; first answers we think are typically not very creative. More original ideas come up after when we reject the most obvious ideas.

Another of Mednick's (1962) findings was the importance of ***remoteness*** of associations. The wider the scope of associative elements, the more creative recombinations will occur. To understand this, Darwin can be seen as a good example; he was well acquainted also outside of his own field biology, and apparently drew analogies from there in constructing his theory of natural selection. He seems to have combined ideas with concepts of variation and selection (from breeding in domestic husbandry) and natural competition (from Malthus). (Glover et al. 1989.) As a conclusion, we could say that both the ***number*** and ***divergency*** of associations seems to influence most to the probability to a birth of a significant creative idea.

However, the role of ***convergent thinking*** in creative process can not to be forgotten either. Its role is essential in, for instance, in the verification phase in narrowing down possibilities in order to reach a workable solution. A point often overlooked is that creative problem solving task alternates continuously between convergent and divergent thinking periods. For example preparation and verification phases, which require focused approaches, involve more thinking of convergent nature. Incubation and illumination phases on the other hand are connected to divergent thinking which produces for more ambiguity and contradictory ideas. (Hennessey & Amabile 2010.)

Convergent Thinking

Disciplined thinking, focused on narrowing possibilities to a workable solution

2.3 MOTIVATION

In the first part of this study, the role of motivation in learning was briefly discussed. The crucial importance of motivation on creativity seems also widely recognized. Haefele (1962) articulates it well:

> *"Only **desire** can drive the preparative work to be well done; only desire can result in frustration - men are not frustrated when they do not care. Only intense desire can arouse anxiety; only fruition of intense desire can evoke elation, and spur the feverish activity of verification.*
>
> (Haefele 1962 p. 24)

Motivation seems to act thus as a ***ground facilitator*** for creative process. Succeeding in any kind of creative behaviour, be it working on a ground-breaking scientific innovation or just to learn mathematics, means that there must be a strong ***inner desire*** to solve the task; without motivation there seems to be no proper results. It's easy to understand that when we are engaged in a task because we *want to*, we are working on it with our full attention and commitment. People who consider their work meaningful keep usually well motivated, as their work fills them with ***energy*** and gives them ***joy***.

Haefele (1962 p. 21) describes a study conducted by Joseph Rossman, a U. S patent examiner, who conducted an investigation on 710 inventors. Inventors described their motives in the following frequency:

Intrinsic motivation

The drive to engage in a task because it is interesting, enjoyable, or positively challenging

Love of inventing	*193*
Desire to improve	*189*
Financial gain	*167*
Necessity or need	*118*
Desire to achieve	*73*
Part of regular job	*59*
Prestige	*27*
Altruistic reasons	*22*
Laziness	*6*

Money can give motivation to some, but as it can be seen, most of the inventors were driven by *internal motives*. The desire to improve existing devices occurs nearly as frequently as love of inventing, and together the two add up to a large proportion of the total. ***Intrinsic motivation*** is a term used for a type of motivation that rises from individual himself; because the task is interesting, enjoyable, or positively challenging (Hennessey & Amabile 2010, p.574).

The importance of intrinsic motivation is especially highlighted in the incubation phase, which has been earlier discovered to be determined by both carefulness of preparative phase and the strength of motivation, latter of which often takes a form of frustration. Carefully made preparation is essential for solving the problem. However, without motivation, the subconscious doesn't usually seem to bothered to participate, and preparation doesn't lead to incubation (Haefele 1962).

There are several studies to suggest that while intrinsic motivation is conducive to creativity, ***extrinsic motivation*** is generally kept detrimental (i.a Florida 2013). Because intrinsic motivation is targeted especially at subjects that the individual has chosen himself (Koski 2001), a university environment that offers opportunities to work on problems that learners have themselves discovered could lead to a essentially improved motivation in learning.

Extrinsic motivation

A driver of behaviour deriving from external rewards such as money, fame, grades, or praise

2.4 INSPIRATION

The word “inspiration” originally refers to an influence by a supernatural being in which the individual is used as an instrument for the delivery of divine truths (Thrash & Elliot 2003 p.871). If intrinsic motivation is considered as a facilitator of the whole creative thinking, inspiration can be seen as a ***facilitator for intrinsic motivation***.

Inspiration

An element that evokes intrinsic motivation with an energizing influence

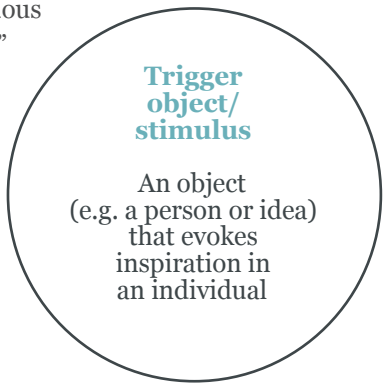
In Thrash’s & Elliot’s study (2003) “Inspiration as a Psychological Construct” these two psychologists define inspiration as *individual’s strong motivational state* that is triggered by a captivating idea or experience of insight. The inspired individual is moved by the truth, ingenuity, goodness, beauty or superiority of the trigger object and is intrinsically motivated to transmit or imitate those qualities. (Thrash & Elliot 2003).

> ***An inspired individual*** *is moved by the truth, goodness, beauty or superiority of a trigger object, and is motivated to transmit or imitate those qualities.*

Inspiration seems thus to evoke interest or astonishment and that way provoke intrinsic motivation, a desire to know more. Even though the concept is ambiguous, some common features on inspiration seem to rise repeatedly up from the literature. Accordingly, inspiration seems to ***energize*** and ***direct behaviour***. It seems also to be ***evoked*** rather than resulted from conscious effort or born without cause. Last, inspiration seems generally to involve a feeling of ***surpassing ordinary preoccupations*** or limitations. (Thrash & Elliot 2003.)

Inspiration appears to be about being moved by something that is good, beautiful or superior to the self in some way. Perceiving this ***trigger stimulus*** gives the individual strong energizing charge, which we call inspiration. Trash and Elliot (2003) describe an informative interview conducted by Hart (1998), who asked the participants to recount experiences of inspiration. The inspired state was found to be characterized by feelings of connection, openness, clarity and energy and as involving enhancement, activation, comfort and a feeling of being overtaken. Another research from Taylor and Lober in 1988 focused on what kind of other patients cancer patients preferred contact with. The result showed that most preferred were the patients who were doing better than the cancer patients, because from them they could gain inspiration and knowledge of coping. (Thrash & Elliot 2003.)

Inspiration comes typically ***from external environment***. Interesting people, music, nature, poetry and art have traditionally been seen as typical trigger stimuli. Perceiving the ***virtue*** of other individual is commonly known as a strong impactor to inspiration. "A positive emotion is elicited when one witnesses virtue and that produces a desire to be virtuous in turn" (Thrash & Elliot 2003 p. 872.)

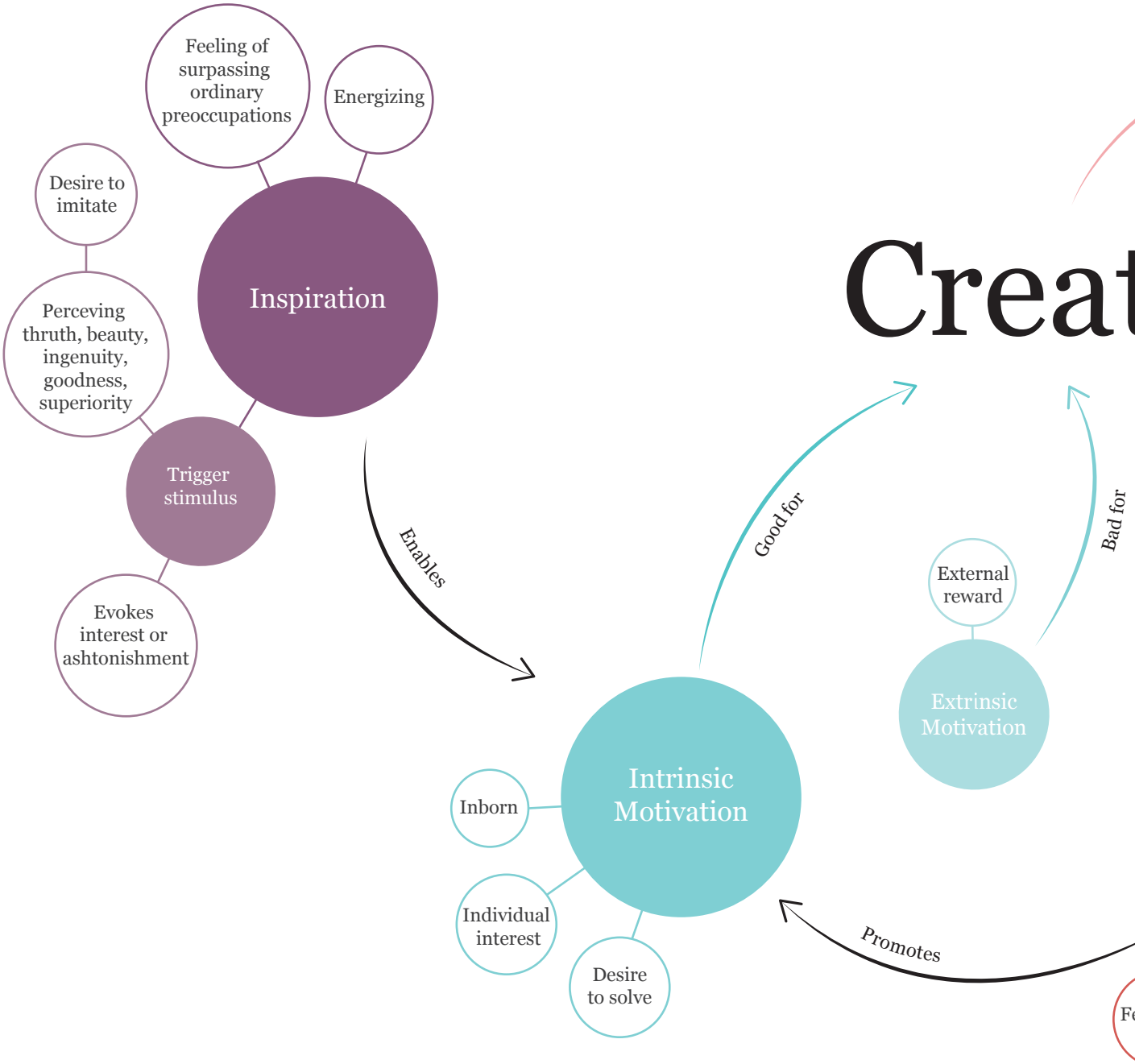


2.4
POSITIVE EMOTION

Most of the experimental studies of moods and creativity have shown that positive emotion leads to higher levels of creativity. The majority of this research indicates that positive emotion facilitates both ***intrinsic motivation*** and ***divergent thinking*** even in especially complex and difficult tasks. For instance, one of the experiments of Amabile and colleagues showed a positive linear relationship with positive feeling and creativity. Result was obtained by multiple daily measures of moods from 222 employees in seven different companies over several weeks, as well as multiple measures of creativity. (Hennessey & Amabile 2010 p. 575)

According to Hennessey & Amabile (2010 p. 575) "positive moods signal to individuals that they are ***safe***, motivating them to seek stimulation and ***think expansively***, making more flexible associations while negative moods signal that there are problems at hand, motivating individuals to think precisely and analytically." Positive moods seem to be often associated with ***physical environment*** and everyday events such as ***social interactions*** (Clements-Croome 2006, p. 29.)

Positive moods signal to individuals that they are save, motivating them to seek stimulation and to **THINK EXPANSIVELY**.


Feeling of surpassing ordinary preoccupations
Energizing
Desire to imitate
Inspiration
Perceving thruth, beauty, ingenuity, goodness, superiority
Trigger stimulus
Evokes interest or ashtonishment
Enables
Creat
Good for
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Extrinsic Motivation
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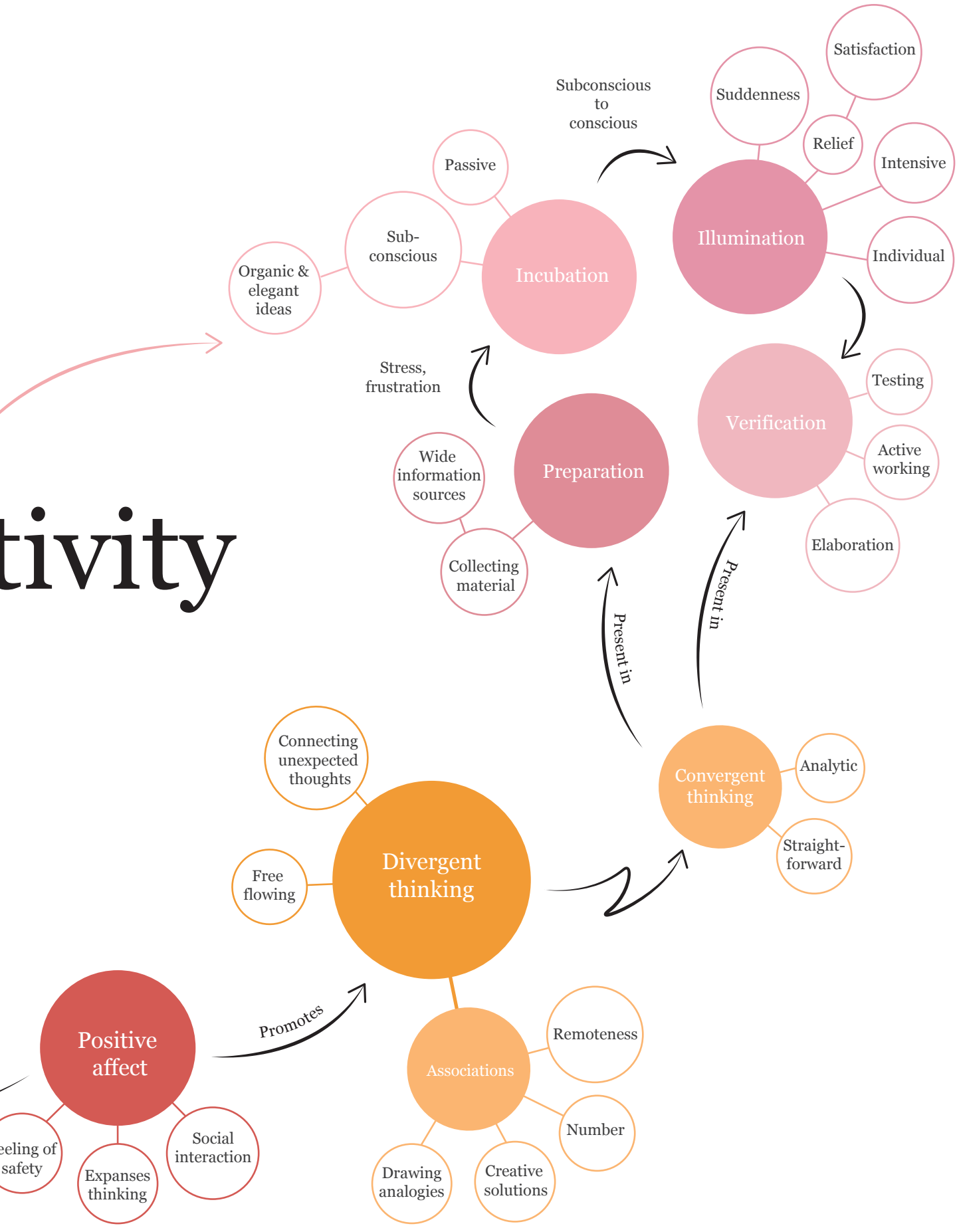

Subconscious to conscious
Satisfaction
Suddenness
Relief
Intensive
Individual
Illumination
Passive
Sub-conscious
Organic & elegant ideas
Incubation
Stress, frustration
Wide information sources
Collecting material
Preparation
Verification
Testing
Active working
Elaboration
Present in
Present in
Connecting unexpected thoughts
Free flowing
Divergent thinking
Convergent thinking
Analytic
Straight-forward
Positive affect
Promotes
eeling of safety
Expanses thinking
Social interaction
Associations
Remoteness
Number
Drawing analogies
Creative solutions

TALENT

ERANCE

OGY

A high
skilled po

A diverse com
tolerances

The

The role of place &

CREATIVE COMMUNITY

3

Globalization and development of virtual networking have brought general speculations of "the end of place". It is likely that learning, information retrieval and social communication could soon be done alone on the Internet and other virtual arenas. What is the role of physical environment in creativity?

hly talented /educat

opulation

When finding ways to develop a creative university environment, investigation of initiators of mere individual creativity is not yet enough. Creativity is a thing that arises from many sources; it's not a product of just a single person's mind. As notified in this study this far, creativity needs a lot of stimuli to have enough associations for divergent thinking, inspirational triggers and material for a successful preparation phase. These all must come from the external environment such as from perceived objects and experiences or from interaction with other people.

There, the role of place and community comes to the fore.

3.1

DOES **PLACE** MATTER?

When looking at the history of great innovative flows, it appears that they mostly occur *locally*. History presents many examples of this clustering nature of high levels of creativity; city of Athens in 400 BC, Florence in its renaissance in 1300-1600, Vienna at the end of nineteenth century and Silicon Valley as a modern example. Of these ***Athens*** presents perhaps the oldest and most powerful one. Athens of 400 BC, smaller that time than the city of Lahti in Finland (Himanen 2007), is known for creating practically the whole basis of western civilization, its philosophy and culture.

Local dynamics seems to be increasingly recognized as a crucial factor for innovativity and is currently a topic of intensive research. Richard Florida, for example, has made pioneering research about this "geography of creativity". His studies show a lot evidence that innovation production has paradoxically become even more concentrated by the globalization than before it. (Florida 2012)

It seems that certain places really are incubators of creativity, innovation and new industries.

*Place **does seem** to matter, but how?*

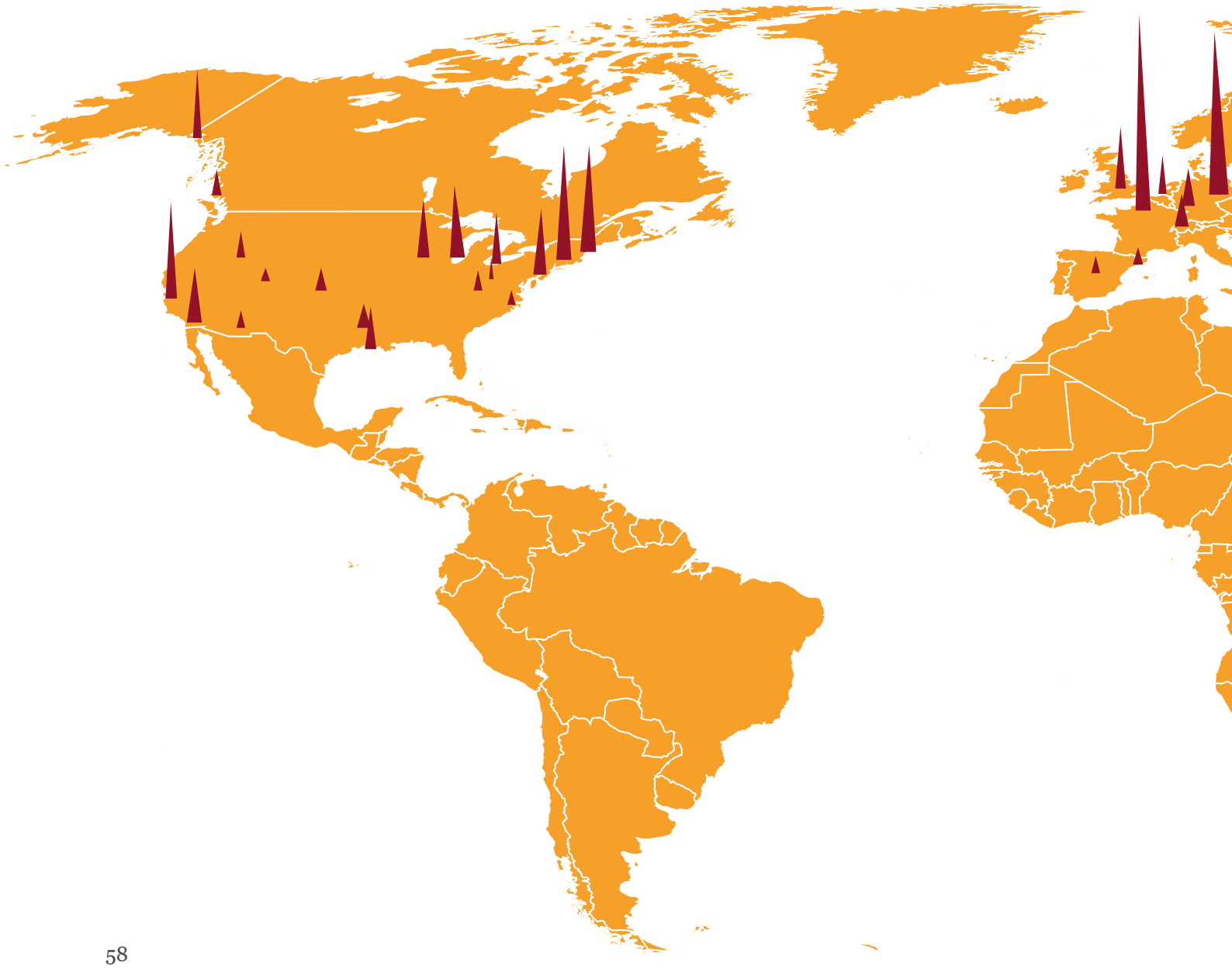
“

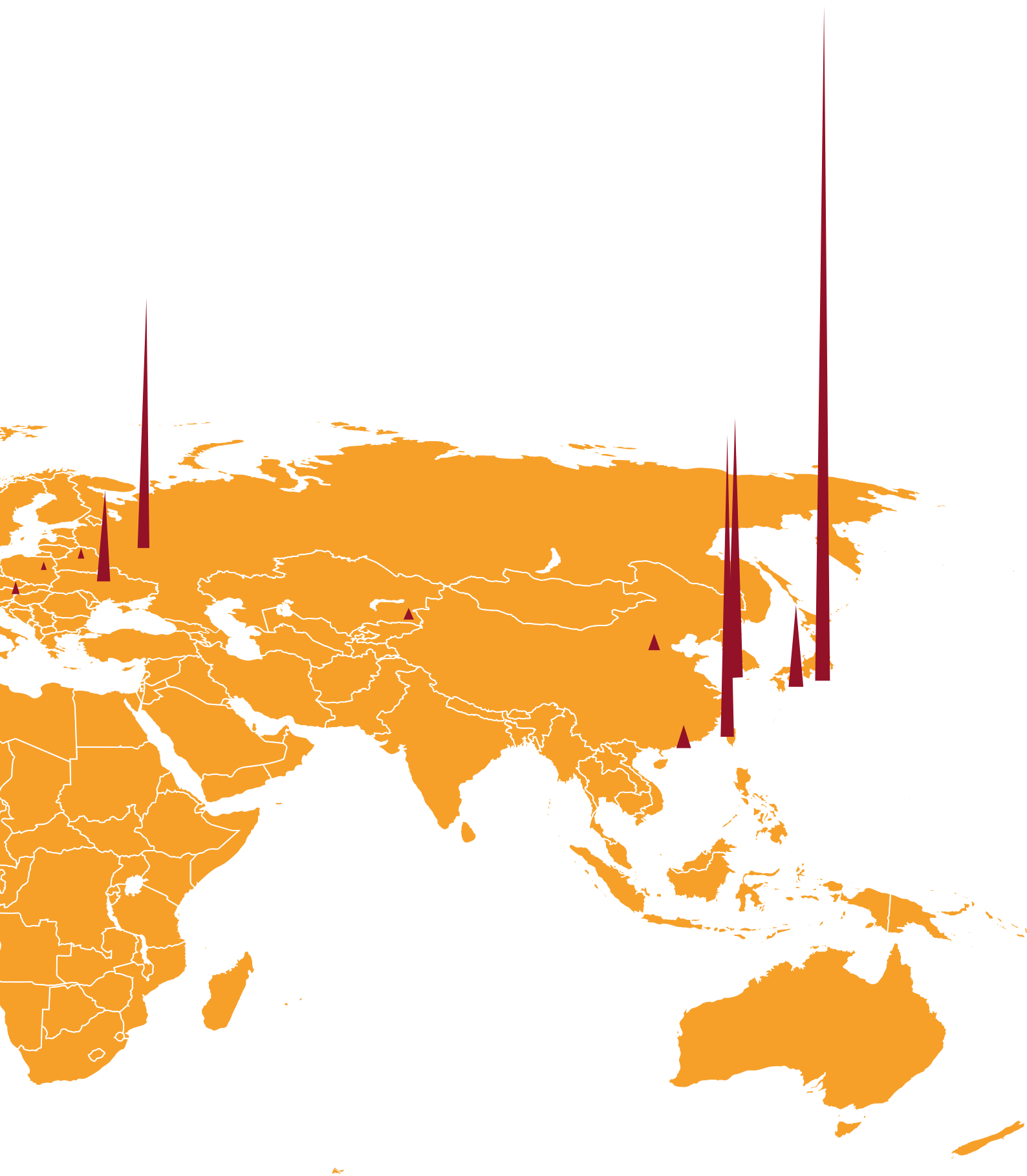
ATHENS *of the 400 BC alone was mighty enough to create the whole basis of western civilization.*

BEING SMALLER THAT TIME THAN THE CITY OF LAHTI

WORLD MAP OF **INNOVATIONS**

The global innovation production based on the amount of patents and trademarks. (Picture after Richard Florida, www creativeclass.com)





3.2
THE ROLE OF **COMMUNITY**

It is easy to see how social interaction would be beneficial for creativity. Social interaction is a quick and easy way of sharing knowledge and opinions and an important way of transmitting emotions. Interaction *serves divergent thinking* by offering individuals divergent associations through new viewpoints, unexpected approaches and fresh ideas from others. It offers material for the *preparation* phase and means of *verification* through the chance of public evaluation. Other people, their personalities, thoughts and skills are likely to raise inspiration, interest and *intrinsic motivation*. Social interaction is also an important source of *positive emotions*.

Studies on creative talents show that creativity seems indeed to nourish itself through interaction. One thing that has been found in common in highly successful creative individuals is their close connections to other highly creative individuals (Collins 2004). History presents several good examples of this, one being the highly productive artistic circles of Montparnasse in Paris after the World War I. In a short period of time this tight concentration of artists was able to generate a bunch of world famous names; Pablo Picasso, Jean Cocteau, Marc Chagall, Ernest Hemingway, Henri Rousseau, Salvador Dali and Joan Miró just to name a few.

> “
> ***Social interaction***
> *serves divergent thinking by offering associations through new viewpoints, unexpected approaches and fresh ideas*

PABLO PICASSO, GUILLAUME APOLLINAIRE, OSSIP ZADKINE, CARMELO GONZALEZ, JULIO GONZALEZ, MOISE KISLING, GAVIN WILLIAMSON, PHILIP MANUEL, JEAN COCTEA ERIK SATIE, MARIOS VARVOGLIS, MARC CHA NINA HAMNETT, JEAN RHYS, FERNAND LÉGER, JACQUES LIPCHITZ, MAX JACOB, BLAISE CENDRARS, CHAIM SOUTINE, JAMES JOYCE, ERNEST HEMINGWAY, MICHEL KIKOINE, PINCHUS KREMEGNE, AMEDEO MODIGLIANI, FORD MADOX FORD, TOÑO SALAZAR, EZRA POUND, MAX ERNST, MARCE DUCHAMP, SUZANNE DUCHAMP-CROTTI, HENRI ROUSSEAU, CONSTANTIN BRÂNCUSI, FORT, JUAN GRIS, DIEGO RIVERA, FEDERICO CANTÚ, ANGEL ZARRAGA, MAREVNA, TSUGUHARU FOUJITA, MARIE VASSILIEFF, LÉ PAUL FARGUE, ALBERTO GIACOMETTI, RENÉ CHÉ, ANDRÉ BRETON, ALFONSO REYES, PASCIN, SALVADOR DALÍ, HENRY MILLER, SAMUEL BECKETT, EMIL CIORAN, REGINAL GRAY, JOAN MIRÓ, EDGAR DEGAS

Some of the famous names from the artistic circles of Paris Montparnasse after the World War I

Intellectual

NETWORKS

& EMOTIONAL ENERGY

How then does the interaction of creative people breed more creative individuals? The force behind this special phenomena has been named as ***intellectual networking*** by an American sociologist Randall Collins, a researcher of local interaction rituals. Intellectual network means a group of people who are interacting in a special way that stimulates the birth of great creative ideas and talents. It is formed out of people who are *oriented* to share their knowledge and thoughts. This special kind of interaction causes associations to flow rapidly together forming thus effectively new combinations and oppositions. Sharing, enriching and combining reflections result in increased creativity. In other words interacting in an intellectual network increases creativity in its members. (Collins 2004.)

Collins names one fundamental factor to conduct this effect; ***emotional energy.*** Emotional energy means individual's strong inborn emotions that have a huge *energizing effect*, such as enthusiasm, goals, creative passion, self confidence or exceeding one's abilities. Intellectual networking makes these emotions reinforced and transmitted. Emotional energy is seen as the central *motivating force* and a powerful source of *inspiration* for the group members. (Collins 2004.)

Emotional energy

Powerful inborn emotions of individual that have a strong energizing effect. For example enthusiasm, goals, creative passion, self confidence or exceeding one's ablitities

> *Interacting in an intellectual network* ***increases creativity in its members.***

And what makes the place important?

When associations are shared in an intellectual network, they become charged with social meanings, Collins claims. Emotional energy seems to require face to face contact since the impact of emotions cannot be transmitted as effectively through virtual paths. The theory of intellectual networks and emotional energy can explain why creativity is apt to cluster locally. A physical place, where these members can meet and interact, is necessary. (Collins 2004)

In addition to the examples from history, there is also recent evidence that can be seen to support Collins' theory. A study conducted by Thomas Allen, for instance, presents one good example of the dominance that face to face contact has on ways of interacting. It investigated the effects that physical proximity had on the probability of interactions between workers of a research laboratory. The study showed that despite the various virtual interaction possibilities, such as email, calls or chats, the probability of interaction started to approach zero after physical distance grew over 25 meters. (After Leonard & Swap 1999 p.141.)

*“Emotional energy requires **face to face contact** since the impact of emotions cannot be transmitted as effectively through virtual paths*

Silicon Valley is an one of the well known innovation centres of the recent decades. There can be pointed out specific places of intellectual networks that have started its famous flows of innovation. “Apple garage” for instance, was a place where a group of IT enthusiasts, called the Homebrew Computer Club, used to meet and share ideas. It it the place where Steve Wozniac one day brought his home-built Apple 1 computer, and so launched the revolution of microcomputers. When examined through the theory of intellectual networks, it seems that the Apple Garage gave a frame for favourable interaction of people with common interests. The interaction made creative ideas shared and amplified. Single ideas were discussed, combined and developed together while the emotional energy of each member influenced the others and drove the creative passion further. (Himanen 2007.)

Apple 1 by Steve Wozniac *Wikimedia Commons*

Intelligent networks seem to be often led by creative role models, inspiring people who evoke a desire to be imitated or competed with. Collins mentions *apprentice chains* as one powerful form of intellectual networking. In an apprentice chain, experienced creative professionals pass their knowledge and emotional energy to the next generation. As a result, the next generation can continue from this cumulative knowledge base. Learning, as its best, follows the same mechanism. Since the apprentice members are then likely to become successful experts themselves and later have their own apprentices, the most competent apprentice chains form a path that can be followed through history. In Athens, for example, the chain of intellectual network started by Socrates was prolonged by his student Plato, and continued further by Plato’s student, Aristotle. (Collins 2004.)

3.3

REQUIREMENTS OF **PHYSICAL ENVIRONMENT**

What kind of places then are able to make ground for intellectual networks? What does the birth of a centre of high creativity require for its environment?

Most obliviously, the first requirement for forming an intellectual network is the presence of creative people. With this in mind, the research results of Richard Florida (2012) indicate that creative people appear to be attracted by the same kind of physical place features. He uses a term "*quality of space"* to describe the set of characters that seem to draw creative people to certain places. The search results emphasize the importance of a wide scope of ***experiences***, and Florida notes that "quality of space" could be even translated as "interrelated set of experiences". Broad labour markets, ***variety of possible lifestyles***, ***social integration***, ***diversity***, ***authenticity***, ***scenes*** (meaning places for experiences) and place's strong ***identity*** have been defined as these characters in Florida's studies. (Florida 2012.)

Nevertheless, it seems that the presence of creative talent by itself is not yet enough (i.a Florida 2012, Himanen 2007). Florida (2012) names three requisites of place that he sees needed for great creative communities and centres of high creativity to come into being. He calls them the 3T's.

The 3T's
BY RICHARD FLORIDA

The features that a place has to possess to cause creativity to concentrate:

TALENT	*A highly talented/educated/ skilled population*
TOLERANCE	*A diverse community that tolerances differences*
TECHNOLOGY	*The technological infrastructure necessary to fuel an entrepreneurial culture*

Richard Florida (2012)

Pekka Himanen (2007) presents also characteristics that are somewhat aligned to those of Florida's: Creative professionals (compare to Florida's Talent), producer structures (compare to Technology) and culture for creativity (compare to Tolerance). By "producer structures" he means all the factors that help ideas to transform into productive objects such as designs, products or businesses. By "culture of creativity" he means a general atmosphere that encourages people to express their creative potential, and has thus a bit wider meaning than Florida's Tolerance.

Both models include the requisite that all the three features must be present ***at the same time*** to have the effect. According to Florida, this explains why some places fail in innovation development despite their high creativity potential or investments on technology. Combining all these three is challenging, and that is why innovation making is led by just a few centralized innovation centres.

“

This explains why some places fail in innovation development despite their high creativity potential or investments on technology.

COMBINING ALL THE THREE IS CHALLENGING,

and that is why innovation making is led by just a few centralized innovation centres.

UNIVERSITIES
AND THE 3T'S

Universities are places that have a high potential to possess all the three T's at once, and it might be one reason why they so often become places of creative communities and effective contributors to regional growth. First, universities are extremely likely to possess a large variety of creative ***talent***. By inspiring and talented teachers, researchers and scientists, universities attract skilled students as well.

Second, universities are centres of latest research knowledge and therefor a possible source of innovations and spin-off companies. That makes them prominent partners for ***technology*** and producer structures. Last, universities are indeed often places of high ***tolerance*** with people from wide scope of nationalities, lifestyles and ideologies. "College towns from Austin to Iowa City have always been places where gays and other outsiders in those parts of the country could find a home" (Florida 2012, p.310).

Wikipedia

^*Frederick Terman*

Dean of Engineering
Stanford University in 1944-1958

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1 Peristyle Court
2 Mint
3 Enneacrounos
4 South stoa
5 Heliaea
6 Strategeion
7 Colonos Agoraios
8 Tholos
9 Agora stone
10 Monument of the Eponymous Heroes
11 Old Bouleuterion
12 New Bouleuterion
13 Temple of Hephaestus (Hephaestion)
14 Temple of Apollo Patroos
15 Stoa of Zeus
16 Altar of the Twelve Gods
17 Royal stoa
18 Temple of Aphrodite Urania
19 Stoa of Hermes
20 Stoa poikile

SILICON VALLEY

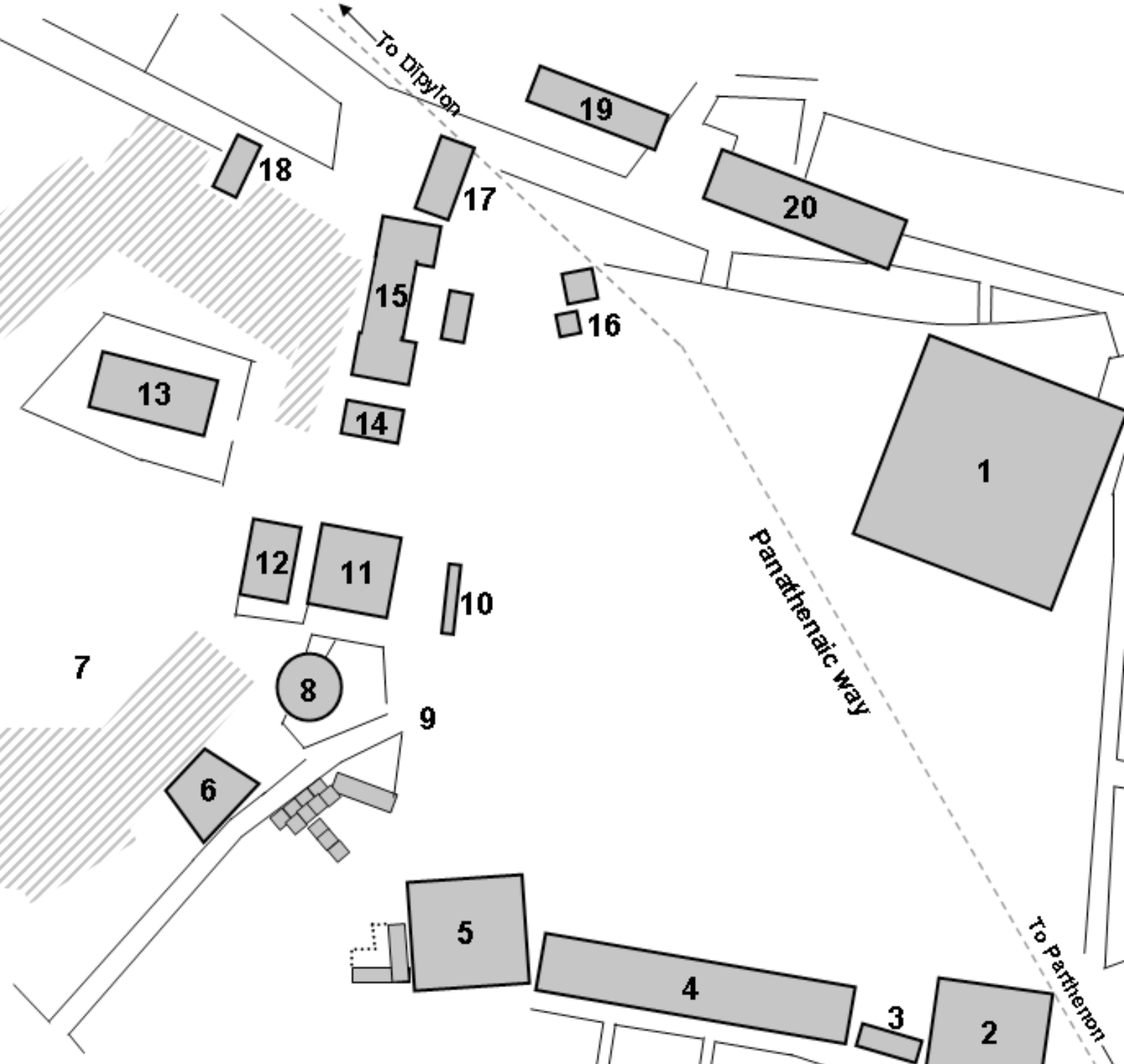
Silicon Valley presents again an interesting example. The success of Silicon Valley has been seen as a consequence of a systematic plan by Frederick Terman, a former Dean of School of Engineering in Stanford University. His ambition was to develop the area into a world's leading innovation centre. Stanford had already a lot of creative professionals (***talent***) among university students and researchers, and the culture for creativity (***tolerance***) had been created by strongly encouraging people to express their creative talents and taking them into action. However, Terman's discovery was to see that the lack of *producer structures* (***technology***) was preventing the success of creative professionals. His answer was to establish Stanford Industrial Park next to the university, where innovative entrepreneurs could rent office space with an expense from 1 dollar per year. Later on, there were several finance and business service providers joining in, and the whole package of producers thus set up. The self-feeding innovation dynamics was born, and ever since Silicon Valley has experienced its famous flows of creativity through the decades. (After Himanen 2007)

Map of Agora of Athens in the 5th century >

Crative Commons

ATHENS

Exactly the same three features can be found from our other example. As mentioned before, ***Athens*** of the 400 BC was situated in an extremely small area and in fact, the essential interaction took place even more concentratedly; at the Agora. At that time Athens was one of the few providers of high education in the world, so it had the advantage of attracting a great deal of creative talent. Technology, from the viewpoint of philosophy, was provided by the physical environment; agora and the gymnasiums were places where philosophy was practiced. Culture for creativity was born out of the competing nature of ancient Greeks; people were contending with each other in doing their utmost. (Himanen 2007)



Coherent Grouping

Work Space Variance

Inspiration

Means of Realization

Openness & Diversity

4 A concept for ARCHITECTURAL DESIGN

What are the space types that creative working requires? How could architecture support the birth of intellectual networks or what could it do to raise inspiration or promote divergent thinking? This chapter presents author's vision of five principles of how architectural design could support previously discovered elements of creativity in learning environment design.

In preceding chapters we have explored a set of the prevailing scientific theories on creativity. The concept of creativity has been enlightened through examination of literature written on psychology, pedagogy, economy and economic geography, and through examples of high creativity centres and by experiences of creators. We have discovered that the aspects of creativity and innovation can be ***advantageous for learning*** and work as important ***competitive advantage of universities.*** They have also been found to initiate regional, national and global ***economic growth*** in the modern knowledge-based society.

Initiators of individual creativity have been pointed out. We have discovered the ***phases of creative process***, the differences in their nature, their typical attributes and essential methods. ***Intrinsic motivation*** has been found to be the ground facilitator for both learning and creativity, and ***inspiration*** as a facilitator for intrinsic motivation. We have also learned how ***inspiration*** is evoked. ***Divergent thinking*** has shown to be the main mechanism of how new ideas are created. Associations are needed for creative ideas, and their number and remoteness have been seen to impact on *how* creative the ideas can be. We have learned ***positive emotion*** to be an important facilitator for both intrinsic motivation and divergent thinking, and physical environment and social interactions its important sources.

Last chapter focused on examining creative communities, their advantages and birth mechanisms. The features of place were found essential in creative centres' birth. We learned that creativity and innovations are fostered best in ***intellectual networks*** and that arranging places to them facilitates their formulation and effective functioning. The need for ***creative professionals, infrastructure for production*** and creativity supporting ***atmosphere*** were recognized. Last, we noted that environment that offers a large variety of ***experiences*** attracts creative people and feeds their creativity.

This theoretical base subverts the illusion of creativity being totally unexplainable and uncontrollable. We can form an assumption that creativity and innovations could be positively affected by supporting the features mentioned above.

In this chapter I will present my understanding on how these features could be supported in learning environment architecture by the means of design. Architecture's potential lies on how it directs the behaviour, interaction and emotions of people. In this case the most important questions can be asked as follows:

How to design an environment that supports individual creativity and at the same time answers to the requirements of creative community? How to open possibilities to get right people together in order to form intellectual networks? What kind of space types could support the characteristics of creative work? And how to offer an environment rich enough to be a source of inspiration, motivation, experiences and associations of maximum divergency and number?

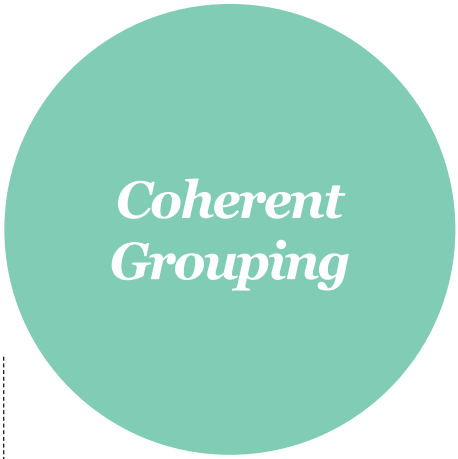
As a conclusion, I suggest that to support creativity and innovation, the place has to be able to:

1. Cluster a large variety of people
2. Provide means for them to form intellectual networks.
3. Get them motivated
4. Provide a work environment that supports the special needs of creative work
5. Provide opportunities for developing creative ideas further into possible innovations

the five PRINCIPLES

For architectural design

I have set my vision of a design concept in the form of these five steps. This chapter introduces the principles in more detail.



Coherent Grouping

Means on how space design could promote the formation of intellectual networks so that the associations and ideas would become enriched in a fertile manner.

Openness & Diversity

Refers to divergent thinking and focuses on how to make the place offer associations, ideas and social connections great in both number and divergency.

Work Space Variance

Suggestions on how the special needs of creative working could be taken into account in space design.

Inspiration

Ways of how the space could offer its users a large variety of inspirational trigger stimuli in order to evoke intrinsic motivation to spur creative work.

Means of Realization

Features that could enable the realizing of ideas, and thus open possibilities for turning them into innovations.

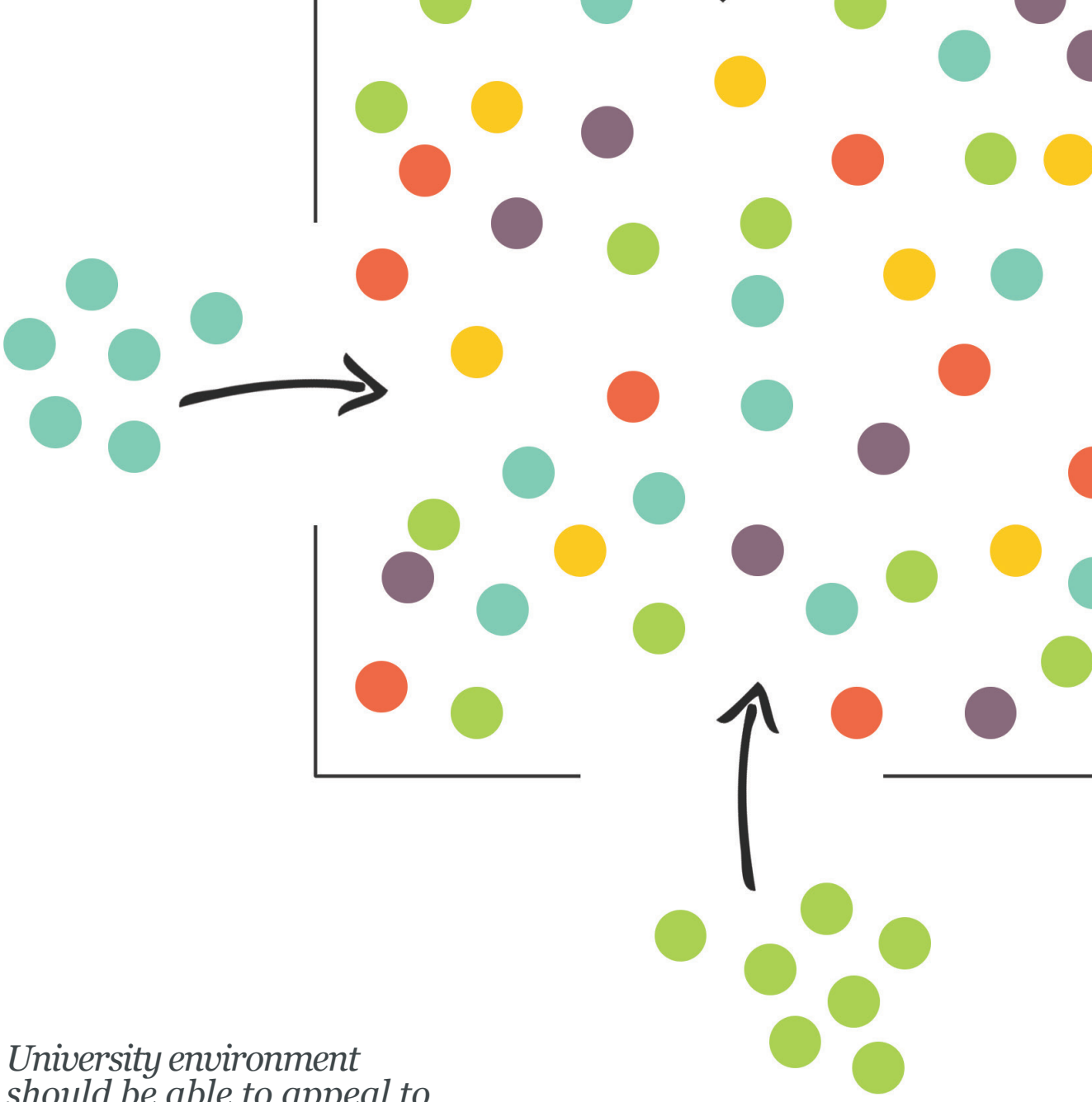
4.1

& OPENNESS DIVERSITY

As discovered by Mednick (1962), the more divergent the associations for divergent thinking are the more creative the ideas formed out of them can be. It could thus be deduced that some heterogeneousness is beneficial for intellectual networks as well. People from different backgrounds, whether from professional or ethnic differences, with new aspects and viewpoints, or associations, are able to wake us up from our conventional paradigms and help us realize new perspectives. It could be assumed that the more heterogeneousness, different backgrounded talent and ways of thinking intellectual network has, the more innovative ideas can be achieved.

In order to make the divergency of viewpoints, perspectives and ideas meet and enrich each other, the ***diversity of creative professionals present*** has an essential role. One of Florida's 3T's (2012), ***tolerance***, calls also for openness to diversity of different people and experiences. His studies have shown a strong correlation between places that are welcoming to "immigrants, artists, gays, bohemians and socioeconomic and racial integration" and places that experience a high level of creativity (Florida 2012, p. 233). I.e Hennessey & Amabile (2010) note also that diversity on sex, ethnicity and other dimensions tend to improve creative task performance. Positive effect to creativity arises especially from underlying differences such as functional background, education or personality of group members (Hennessey & Amabile 2010).

> *"To make the divergency of viewpoints, perspectives and ideas meet and enrich each other, the* ***diversity of creative professionals has an essential role.***



University environment should be able to appeal to people with ***different lifestyles, personalities, cultures, thinking styles and ethnic backgrounds***

To gain this multitude of creative talent, learning environment should thus be able to ***appeal to different fields of expertise***, university professionals of different levels such as students, researchers and professors as well as ***people from working life***. It has to be able to ***support different lifestyles, personalities, cultures, thinking styles and ethnic backgrounds*** to lure their representatives. This means also lowering the entry barriers; newcomers should be easily taken in the social community and its arrangements. Building itself should be ***visible and approachable***, providing ***easy access*** and a sense of ***welcoming*** from all its sides.

“

***International** people*
reinforce creative interaction
*effectively with **complementary***
skills and knowledge

INTERNATIONALITY

Multicultural experiences offer a significant source of divergent viewpoints and associations. Empirical testing shows that exposure to multiple cultures can enhance creative behaviour (Hennessey & Amabile 2010). Also Richard Florida emphasizes the role of ethnic diversity (Florida 2012). People coming from different parts of the world reinforce interaction with different approaches since the skills and knowledge compositions of multinational people are usually complementary to that of natives.

Strongest cities and countries have always been melting pots of races and cultures. The US makes a good example; practically born out of immigrants - Spanish, Portuguese, Dutch, English and French explorers - and known afterwards for its liberal immigration policy, the US has developed in one of the leading economies in the world of innovations. In the case of ***Silicon Valley*** again, the foreign population has been shown to form almost half of its innovational power, its engineers and business leaders (Himanen 2007 p. 56). Also a half of the start-up companies of Silicon Valley involve immigrants (Florida 2012). It has also been estimated that about a third of ***Athens***' population was foreign-born (Himanen 2007 p. 71).

In order to attract international people, the first thing is that their ***needs*** should be taken into account. Coherently designed space functions that answer their needs would signal that they are ***appreciated*** and ***welcomed***. Environment can provide foreigners with a ***"home base"*** to ease their culture migration and to give possibilities to ***express themselves*** in a familiar way. It could be helpful if architecture would offer places where international people could ***gather*** and ***share experiences*** in peer groups.

New technology provides simple means to foster worldwide connections. ***Virtual environments*** where research projects, student groups and international students can connect with their world peer groups would enable ***worldwide interaction***. Cooperation with other Finnish or international universities through ***video negotiations***, ***lectures*** or ***workshops*** would easily expand the professional network even further.

4.2
COHERENT **GROUPING**

When the necessary number and divergency of people and ideas have been achieved in one way or another, the next question arises: how to get individuals to form intellectual networks?

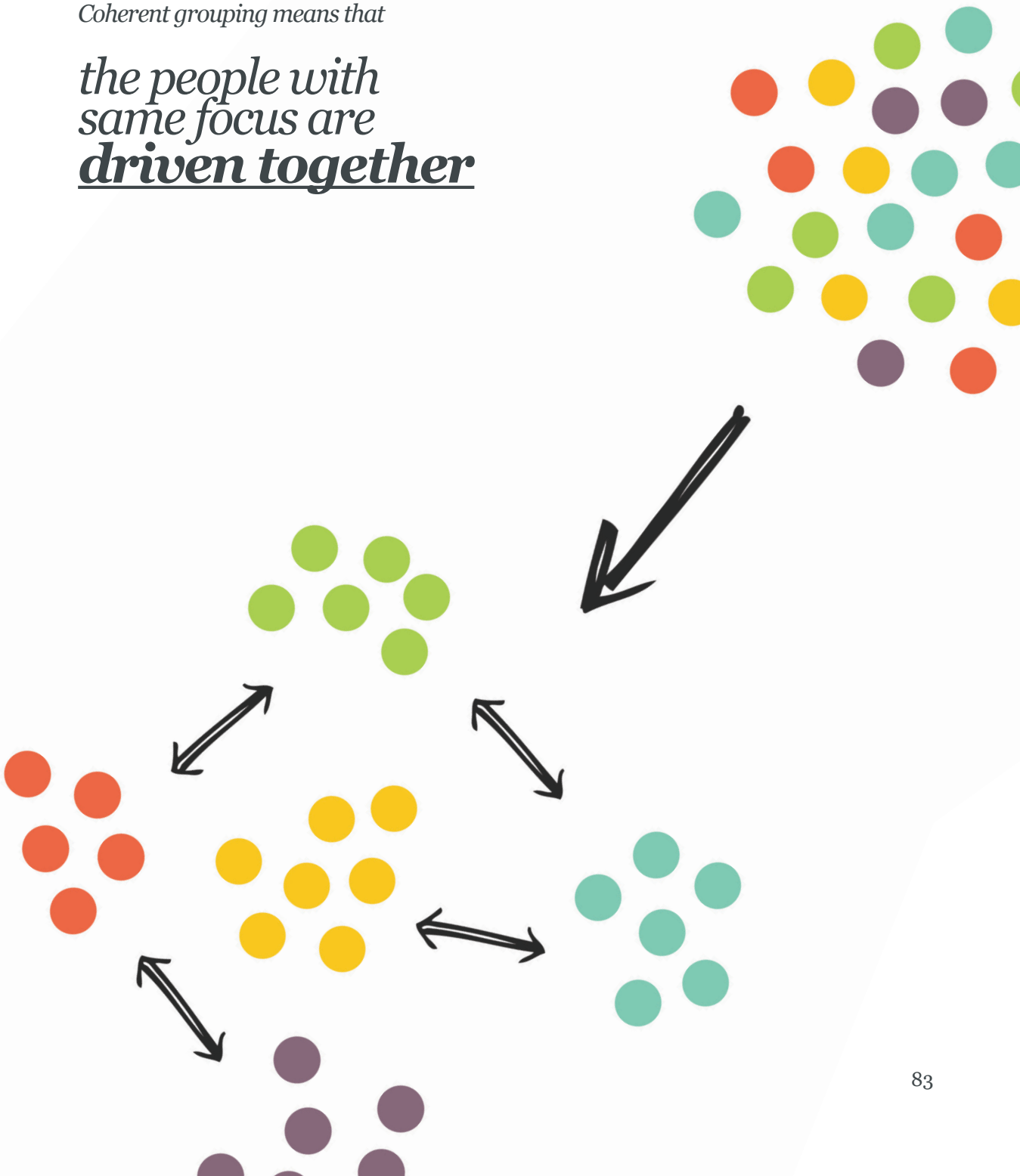
In precedent chapters we learned that *emotional energy* is a ground factor in intellectual networking. Its effective transmission requires that the participants are able to be caught up in each other's emotions. This means that they must be focusing their attention on the same thing while being aware of each other's focus. Intellectual networks could thus be formed out of people who ***share parallel interests*** and passions or are in identical situations. In brief: people who have in common something that motivates and inspires them generate emotional energy which spurs the creative action of intellectual networking.

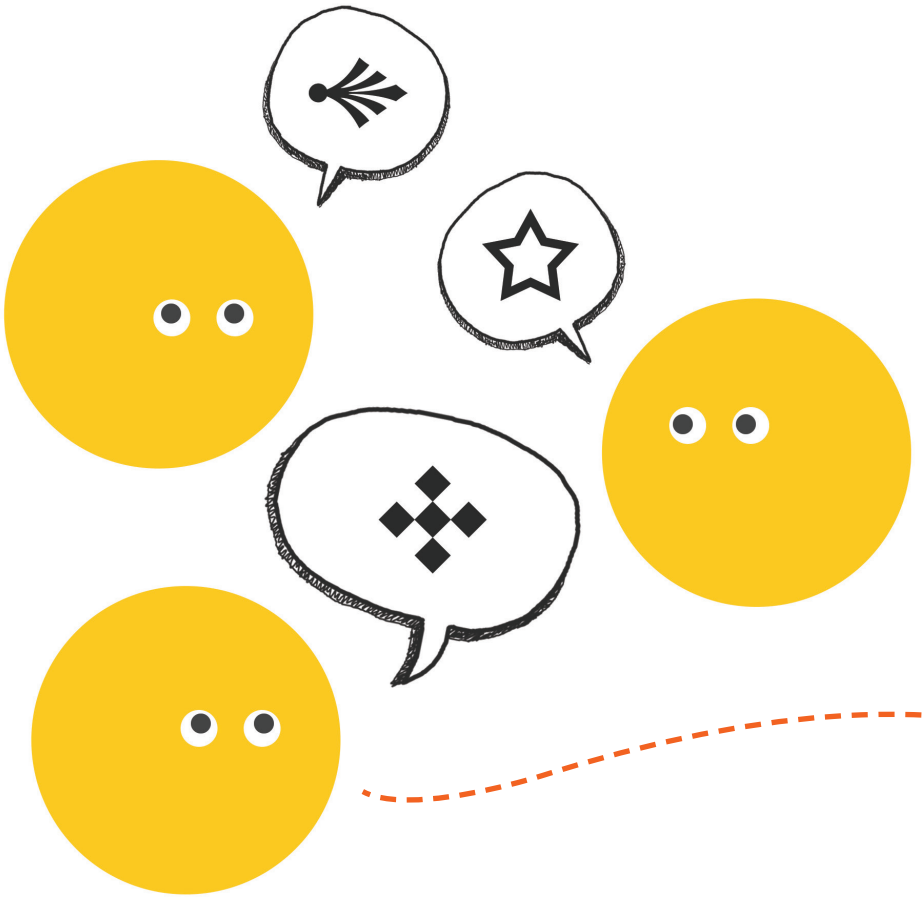
By *coherent grouping* I mean that people with the same focus are ***driven together***. Architecture could influence this by varying ***the proximity*** and ***supply of functions*** in order to influence encounters between their users. For example spaces of users who would benefit from each other's work should be placed near each other. Also selecting the kind of space functions that spontaneously ***attract people with same interests,*** such as student clubs, would lead to serendipitous encounters. We could also increase the possibility of accidental encounters by facilitating ***spontaneous communication*** by directing the flow of people and adjusting the openness of spaces coherently.

“

Coherent grouping means that

the people with same focus are ***driven together***



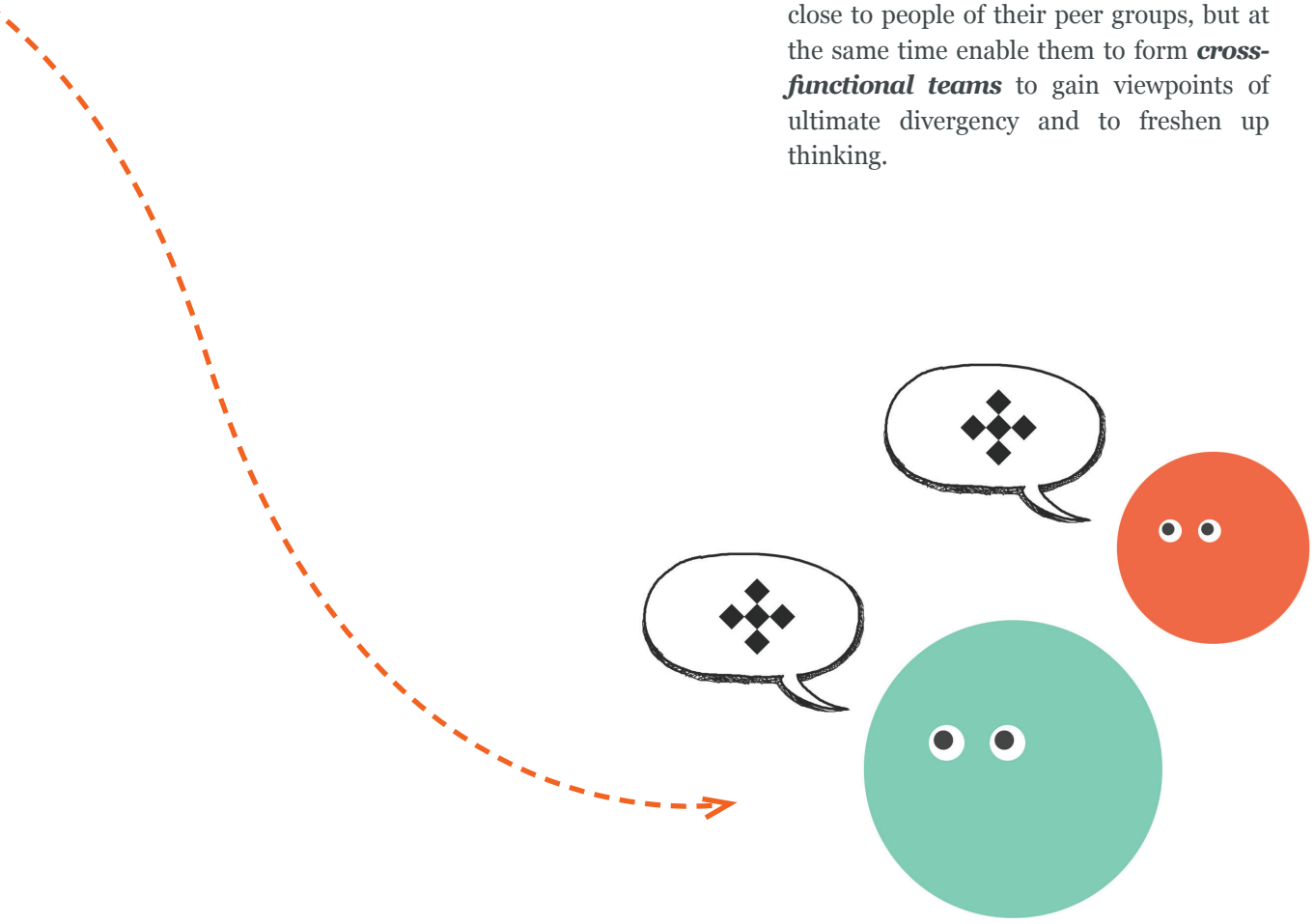


The people that would be most beneficial to each other cannot be predefined exactly, but research gives some directional knowledge of the subject. Certain ***stability,*** together with sufficient heterogeneity, of the networks seems to be an important factor. Florida (2012) describes a successful creative network to be ”stable enough to allow for continuity of effort, and yet diverse and broad-minded enough to nourish creativity in all its subversive forms” (Florida 2012 p.22). This means that the group members should be related in a way that keeps them steadily together, but still have a large scope of different perspectives and viewpoints. Hence, recognizing and forming effective ***peer groups*** is beneficial.

In the case of learning environment this could mean for example that the functional group would be formed out of professionals ***on same level of expertise*** but from ***various expertise fields***. Researchers from different faculties share the same interests on research but have divergent approaches and methods according to their field’s traditions, which is apt to provide fresh perspectives to others. They can thus be able to form an intellectual network where knowledge is shared and interest, enthusiasm and new ideas raised, and where a positive competition spurs working. Interaction with some other peer group members, i.e. students, cannot be seen as advantageous from this point of view.

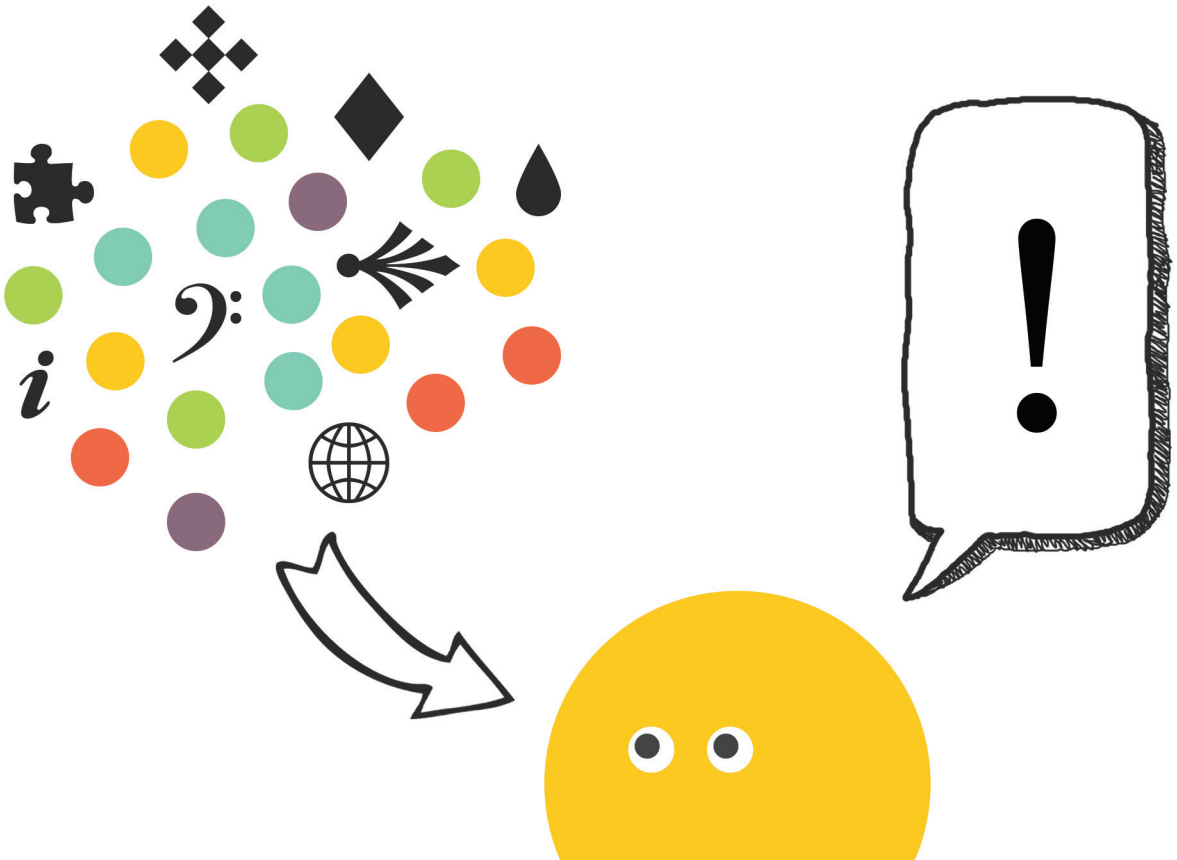
Obviously, to get these people to form intellectual networks, they have to get into interaction. A false illusion, yet surprisingly common, is that people would communicate for mere chance of interaction. There are many places for coexistence where plenty of people from different backgrounds meet but a real interaction never happens; cafés and restaurants, passive teacher-led lectures and anonymous public places such as corridors. This kind of social coexistence might have a lot to do with well-being and boosting creativity in that sense, but in forming intellectual networks it has minor substance. Finding peer members efficiently requires that the interaction happens ***actively***; by familiarizing with other individuals, changing ideas and through discussions. This could be achieved if ***places of interaction are functional***. Places where people work together or come to ***play***, ***express themselves*** or ***debate*** are presumably more likely to provoke this kind of meaningful interaction.

An efficient creative community would be formed out of a number of heterogeneous intellectual networks. Anyhow, to maximize the benefits of a wide scope of professionals and associations, the creative community would be most efficient when ideas would be changed not only inside the intelligent networks but also ***between*** them. This means that individuals should have an opportunity to belong to many peer groups at the same time and ***shift easily*** between them. In other words, architecture should direct people to work close to people of their peer groups, but at the same time enable them to form ***cross-functional teams*** to gain viewpoints of ultimate divergency and to freshen up thinking.



4.3 INSPIRATION

The best teachers are usually those who succeed in raising interest. Maybe the same applies to learning environments as well? As discovered before, inspiration involves a perception of something that an individual senses good, beautiful or superior to himself. As for architectural design I suggest that environment's ***transparency*** could offer a lot to inspiration. Exposing what other people, in the same or other situations, are doing and what they are interested in can evoke new points of interest to other individuals as well. Here also, the ***placing*** of different functions is essential. The individuals that are likely to get inspired by each other's doing should be ***guided towards each other***.



> *Environment's* ***transparency*** *could offer a lot to inspiration*

Divergency can be again regarded beneficial for ***inspiration sources***. When there are a lot of different possibilities to get inspired, individuals, being divergent themselves, are more likely to find coherent trigger objects that evoke interest in them.

Learning is a thing that can be highly inspiring. Perhaps resulting from traditional classroom types, it is however often kept conversely out of public sight behind closed doors. Increasing the ***transparency of lecture spaces***, offering possibilities to ***see the scope*** of subjects taught and even to ***spontaneously participate*** in interesting lectures could significantly magnify the level of inspiration and intrinsic motivation. The more we know, the more interest increases.

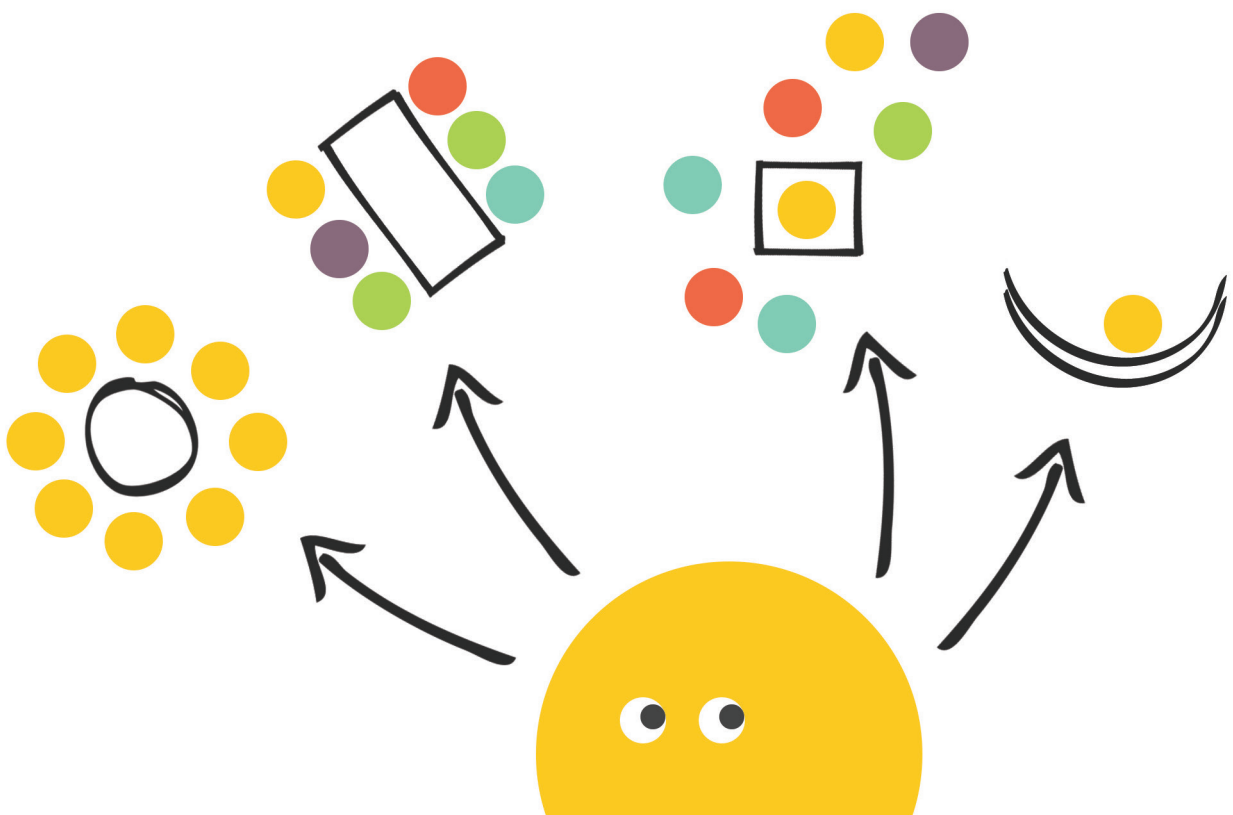
Wide scope of ***experiences*** has been introduced as Richard Florida's vision for the top quality of place preferred by creative people. Experiences are events that leave impression on individuals and can then provide new platforms of thinking and direct their future behaviour. Experiences are important because they are able to *switch thinking perspectives*. Sudden or occasional interacting with people from different levels of expertise, ethnic backgrounds or lifestyles can offer experiences that broaden thinking and offer new points of interest.

Also ***architecture itself*** can inspire. Csikszentmihalyi (1996 p.135-139) presents that ***different*** and ***unusual environments*** stimulate especially the insight phase of creative process. Inspirational learning environment should be thus ***rich in its architectural expression*** and provide a vivid diversity of spatialities.

Perceiving the reason of studying or research can also evoke interest. That's why dealing with ***real subjects*** is inspiring. Environment should thus provide possibilities for real interaction with taught or researched subjects. For example real interaction with multinational people exposes the need for language skills and so inspires language learning. ***Participation in real research projects*** and working side by side with talented professionals on real research problems could evoke inspiration in same way. When reaching at maximizing the motivational state of students, learning shouldn't be seen as an individual's own passive knowledge adoption process, but a real participation and growth into a member of a professional community.

4.4
WORK SPACE **VARIANCE**

Since the needs of different phases of the creative process are so diverse, also working methods vary contrastively between them. Creative work could be described to be highly flexible and individualized in its nature, requiring thus a ***multitude of work spaces*** that enable work in different environments and group compositions. System should also allow people to ***change simultaneously*** between different work environments to support the quick switches between the phases and to have new stimuli and change of viewpoints.



As learned, the creative working process alternates between highly intensive group work, ascetic solitary work, highly concentrated thinking and relaxed detaching periods. There are ***introverted*** periods which contain meticulous reflection, studying and enhancing personal expertise and skills, and ***extroverted*** phases that are needed for interaction, conversation and sharing influence and feedback with others. There should be a variety of spaces for both ***peaceful individual*** and ***active group work*** as well as suitable places for special working types such as computer work, reading, guided and self-oriented work.

When designing spaces also for active learning, the environment should as well provide spaces that enable large variety of teaching and learning methods. As discovered, intrinsic motivation seems to be raised best when learning is active and self-oriented. There should be enough spaces that ***support active teaching*** such as places for ***observation***, ***guided group work*** or ***investigation of explanatory models***. Self-orientated learning requires also that learners have ***easy access to knowledge*** themselves. Learning environment should thus provide users with large ***variety of information forms***. Books, internet and for example other people's achievements are good sources to gather information for instance to support the requirements of preparation phase.

Traditional learning environments such as ***lecture rooms*** remain also needed. A closed room specified to teacher-led learning is relevant when facts, concepts and information are distributed, that is, when cognitive background is formed for the task. As the need for other space types increases, it means that traditional learning spaces have to develop to require less space. This can be made by ***flexibility***. For example a possibility to ***divide*** or use space for ***multiple purposes*** doesn't reduce its usability but only the space need.

> *Creative work requires a* ***multitude*** *of work spaces that enable work in different group compositions and environments*

Again, as important as creating a multitude of different space types is how these space types are ***placed***. Instead of having a row of other lecture rooms nearby, the proximity of experimental testing places, such as laboratories or workshop rooms, can encourage teachers to keep more interactive lectures. Work environments for occasional and even spontaneous cooperation among people from different backgrounds could be supported by placing workplaces ***on the borders*** of different peer groups' stations.

Parking et al. (2011) refer to Allen, Kraut et al., Toker and Gray when reporting that people are more likely to interact and collaborate with colleagues whose workstations are ***physically proximal*** to their own, ***easily accessible*** and ***highly visible*** from communal areas. It can therefore be suggested that ***openness*** of a creative working environment could be an important value.

Also ***environment around workplaces*** is an important thing to consider. Preparation and incubation are phases where a complex environment with a ***lot of diverse stimuli*** could be useful for providing new associations. On the other hand, periods of verification and certain periods of preparation can take place in more ordinary environments. Then sometimes, for example just after the insight, the creator should be provided with an ***extreme peace*** for concentrating on refining the idea.

Creative laziness:
PLACES FOR RESTING

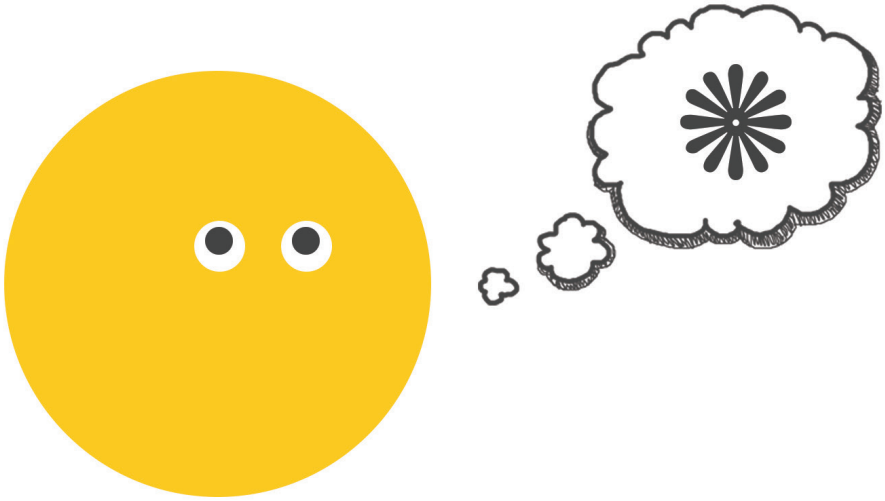
One major point that seems to be mostly ignored in campus design is a need of rest and detaching. Most of the campus areas are filled with lecture halls and auditoriums, a.k.a environments of active working (Keskinen 2014). However, *detaching* plays an essential role in mental processes. As we have learned, subconscious, which is mostly responsible for incubation, requires a chance for rest from the pace of intense work.

It seems that turning attention to other things is often the best way of detaching from the problem at hand. Florida (2012), for example, notes ***active recreation*** to be a common detaching method of creative people. Mental engagement to an intense activity is apt to offer a profound release from work. Glover et al. (1989 p. 240) point also out that leisure activities can provide one of the few opportunities for people to engage in exploratory, divergent, and creative activities instead of problem solving, goal directed and convergent functions. Leisure activities often promote self expression, autonomous control and make individuals to seek novel and unfamiliar experiences. In addition, leisure activities rise usually from intrinsic motivation. (Glover et al. 1989). Individuals have their own ways of detaching, so the environment should support them with ***various possibilities*** to refresh, exercise and socialize.

Uncontrolled stress easily destroys conditions to be creative and is something that is likely to drive positive emotions away. As mentioned before, frustration and "pain of creativity" are often necessarily involved in the creative process, so environment should be able to ***calm*** the stressed mind. For example bringing ***nature*** as a visible part to interiors could be beneficial due to its proven influence on stress relief and recreation (i.a Aura et al. 1997 p.94-104).

Another issue desirable to prevent is fatigue; being tired decreases the ability to learn, memorize and think creatively. Clements-Croome (2006 p.28) describes the alternation of efficient and inefficient working periods and notes that our attention span usually lasts about 90-120 minutes, after which natural fatigue takes place and the concentration drops. Effective working requires thus rest along with active behaviour. Csikszentmihalyi (1996, p.55-76) notes that a considerable need of sleep is typical for highly creative people, which is to balance intense working periods. Creativity requires optimal energy levels, and without proper resting it's not possible.

Environment that supports creativity should thus offer possibilities to ***direct sleeping*** as well as ***relaxing***, ***quiet working***, ***meditation*** and different types of ***active detaching***. Providing users with these kind of places enhances subconscious working, positive emotions and work efficiency.

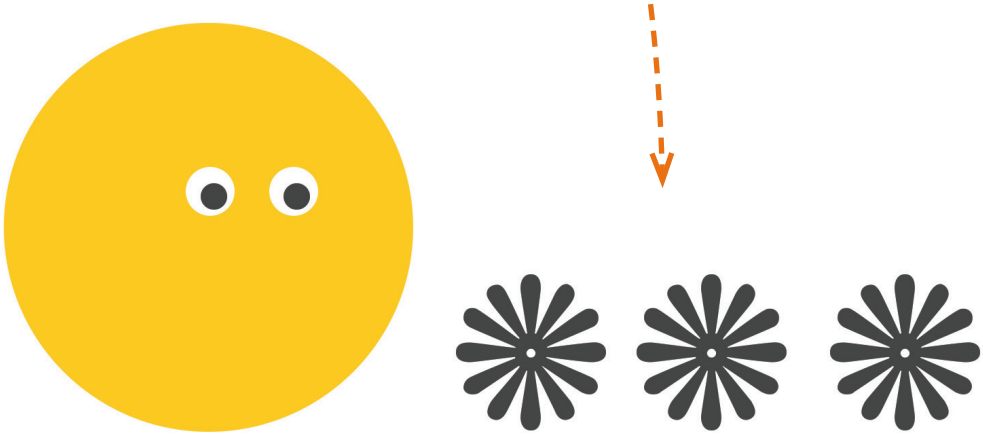


4.4 MEANS OF **REALIZATION**

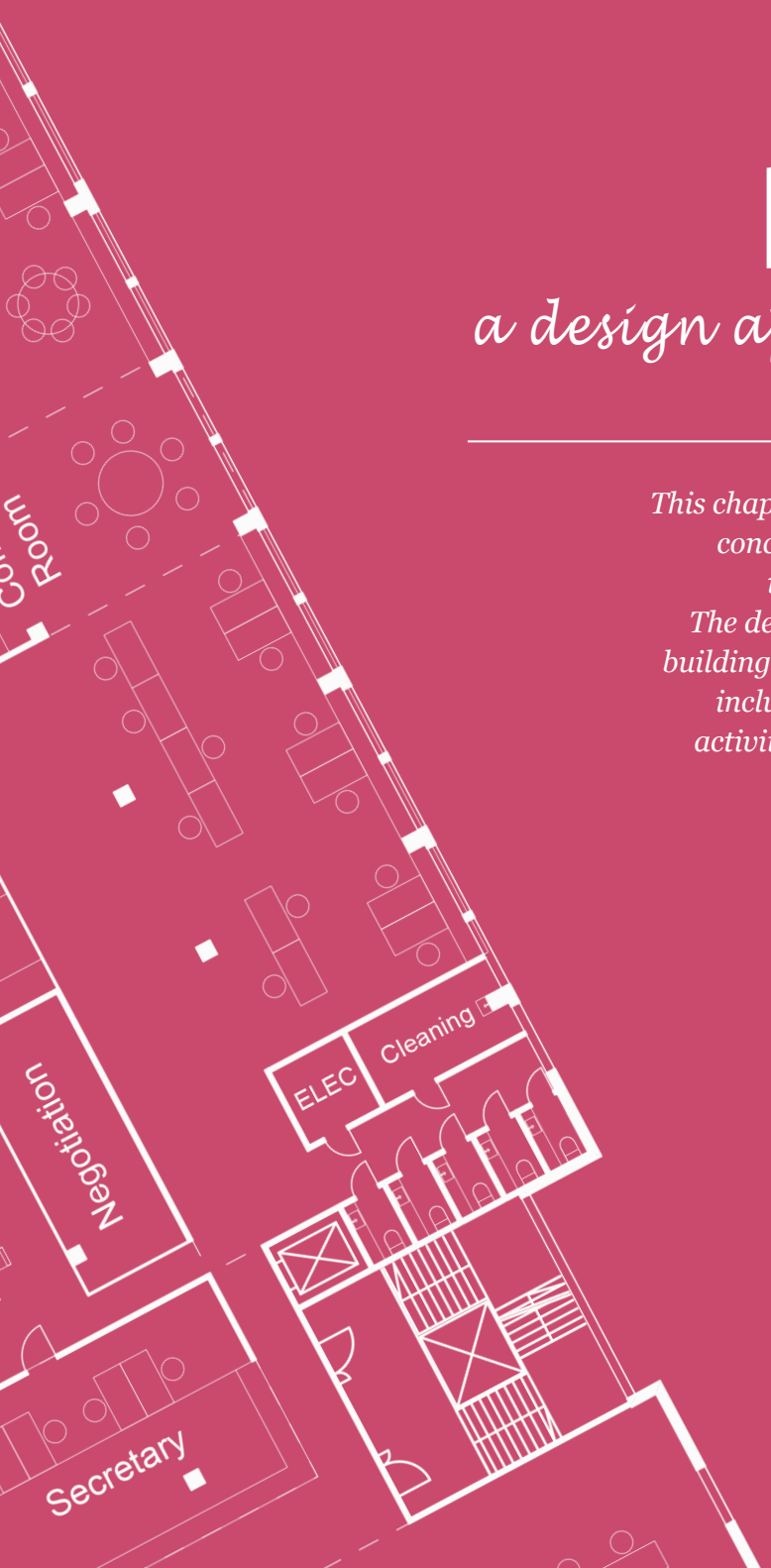
As important as to have ideas is to be able to make them real. Providing means for realization refers to the features represented by Florida with the name ”technology” and Himanen with ”producer structures”. They mean any features that enable realizing ideas. They naturally vary depending on types of ideas and innovations. For a painting, means of realization are a canvas, brush and paint, whereas business innovation may require heavy manufacturing resources and investors to allocate capital for massive production.

The principle Means of Realization refers to verification, the last phase in the creative process, where ideas are elaborated and reformed to their final forms. ***Public recognition*** can be seen as an important mean of realization when talking about creative ideas. Innovations cannot be implemented without a field of other experts to recognize and validate them.

In the case of campus environment, means of realization could be considered for example as ***premises for further development*** of ideas (as in the example of Silicon Valley) or as suitable ***equipment for testing*** and ***manufacturing*** pilot versions of ideas, or ***places where ideas can be presented*** to the public.




Negotiation
Access of students
Secretary
Negotiation
Copy
Library
Soc.
Soc.
Garden
Common coffee room
Library
Rest
Copy



PIM!

a design application

5

This chapter presents an example of how the design concept introduced in the last chapter could be interpreted into practical design solutions. The design is implemented into an old university building in Tampere University of Technology and includes thus an approach to retrofitting novel activities into an existing learning environment.

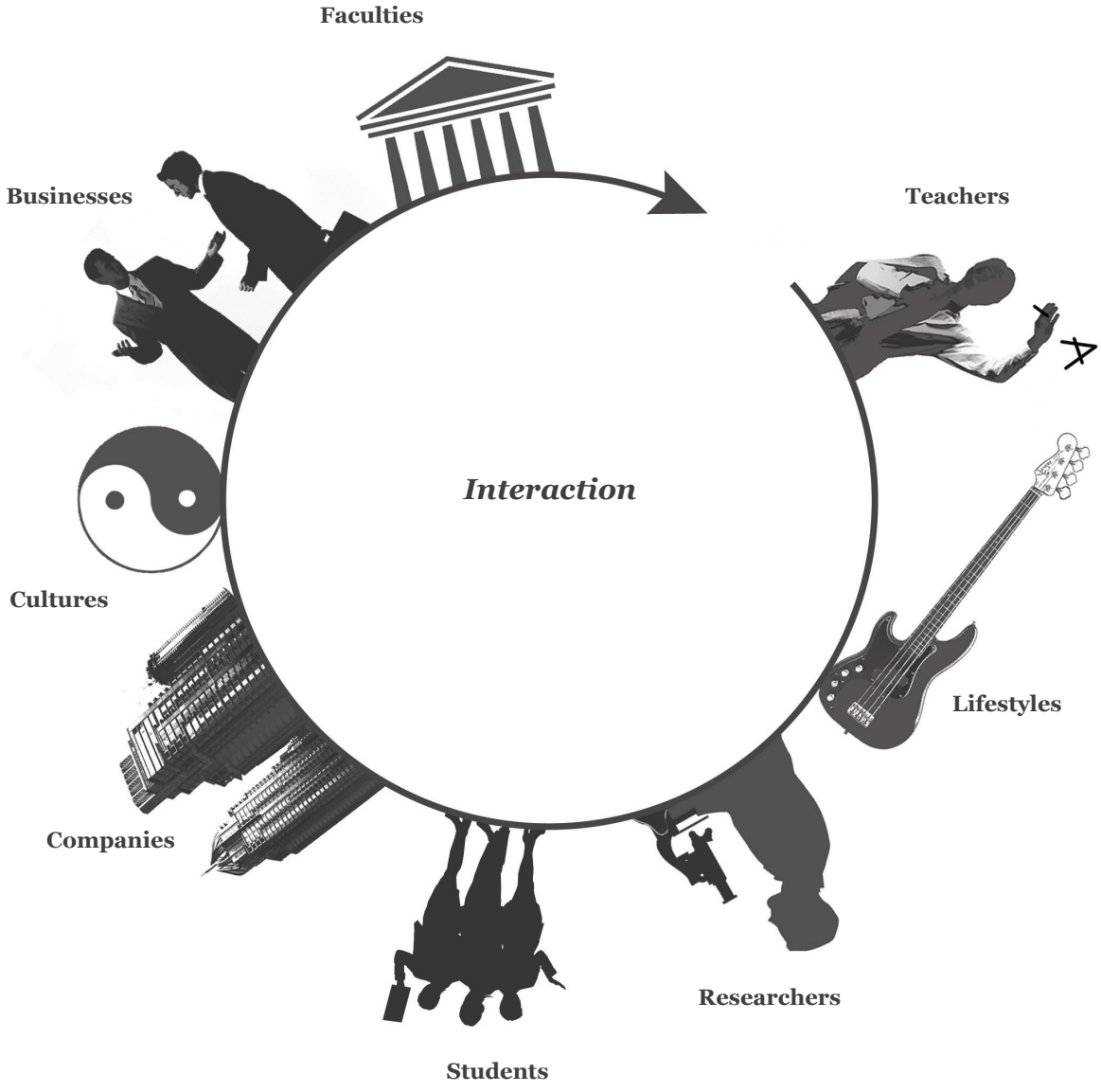
Fundamental IDEAS

The design transforms an existing university building into an innovation centre common for all campus users. Designing has been approached from the demands of creative work, and from the idea of combining learning and innovation making for their reciprocal benefit. Learning is intended to be conducted by student-directed, research driven ways based on constructive learning methods that have been presented in the introduction of the study.

One of the main design objectives has been on promoting motivation of users in various levels. For example increasing ***transparency of activities*** or enabling opportunities for ***interactive and spontaneous learning*** aim at maximizing curiosity, interest and wondering of users. Possibilities for meaningful ***self-learning*** and ***individual research*** direct users to evolve their ***personal abilities***. Dealing with ***real subjects*** that have real ***development opportunities*** encourages inventiveness and learning.

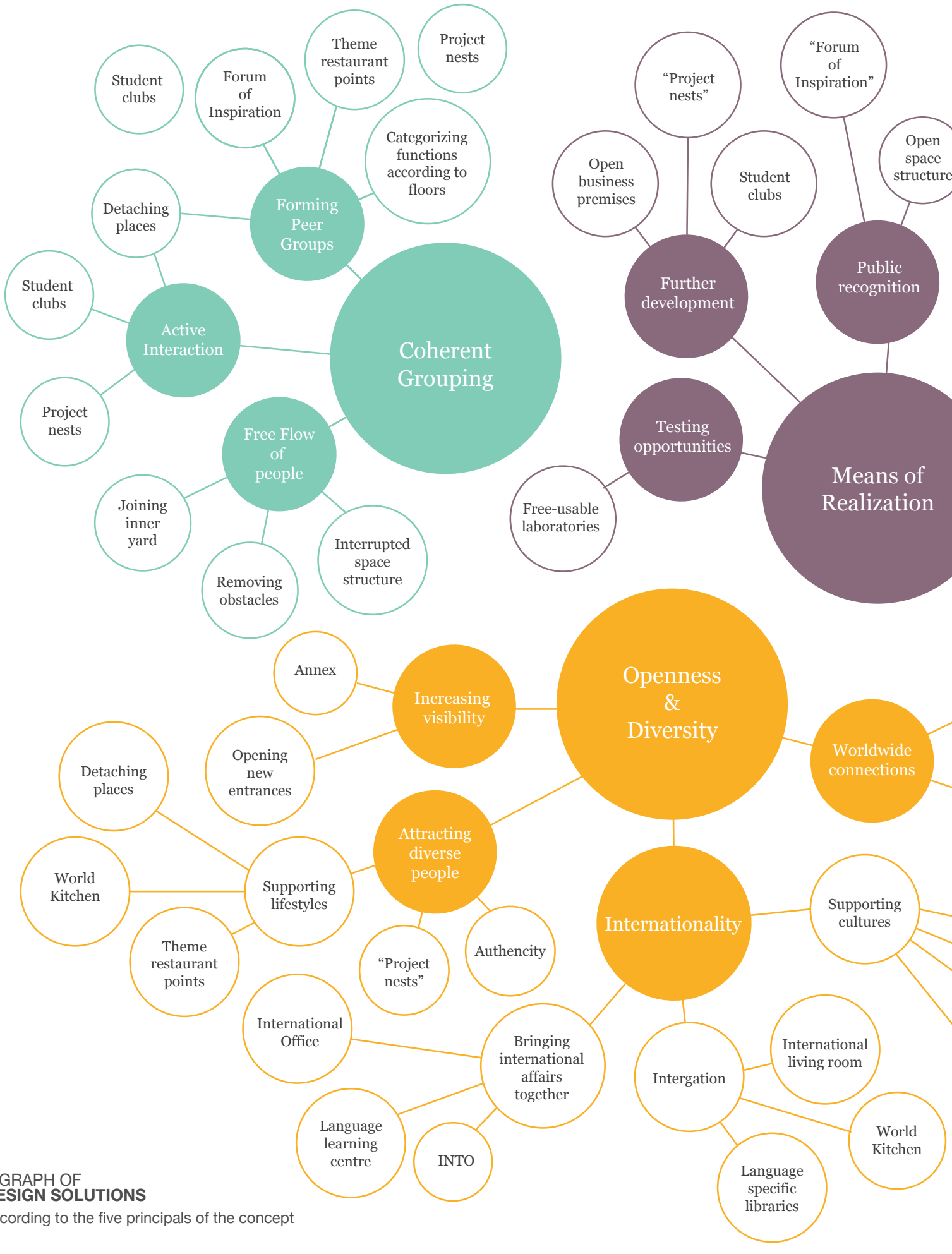
The importance of ***social interaction*** has been recognized earlier in this study. Especially the interaction between different expertise fields is important since it's likely to create boundary surfaces where ideas from different backgrounds can collide and so generate entirely new ones.

Interaction is one major thing that can be influenced by architectural design. The ***nature*** of interaction can be influenced by selecting relevant space functions. By placing them coherently, we can in turn ***direct*** the interaction between the people that are most likely to be beneficial to each other. Last, varying the openness of space structure can influence on ***how much*** interaction happens.

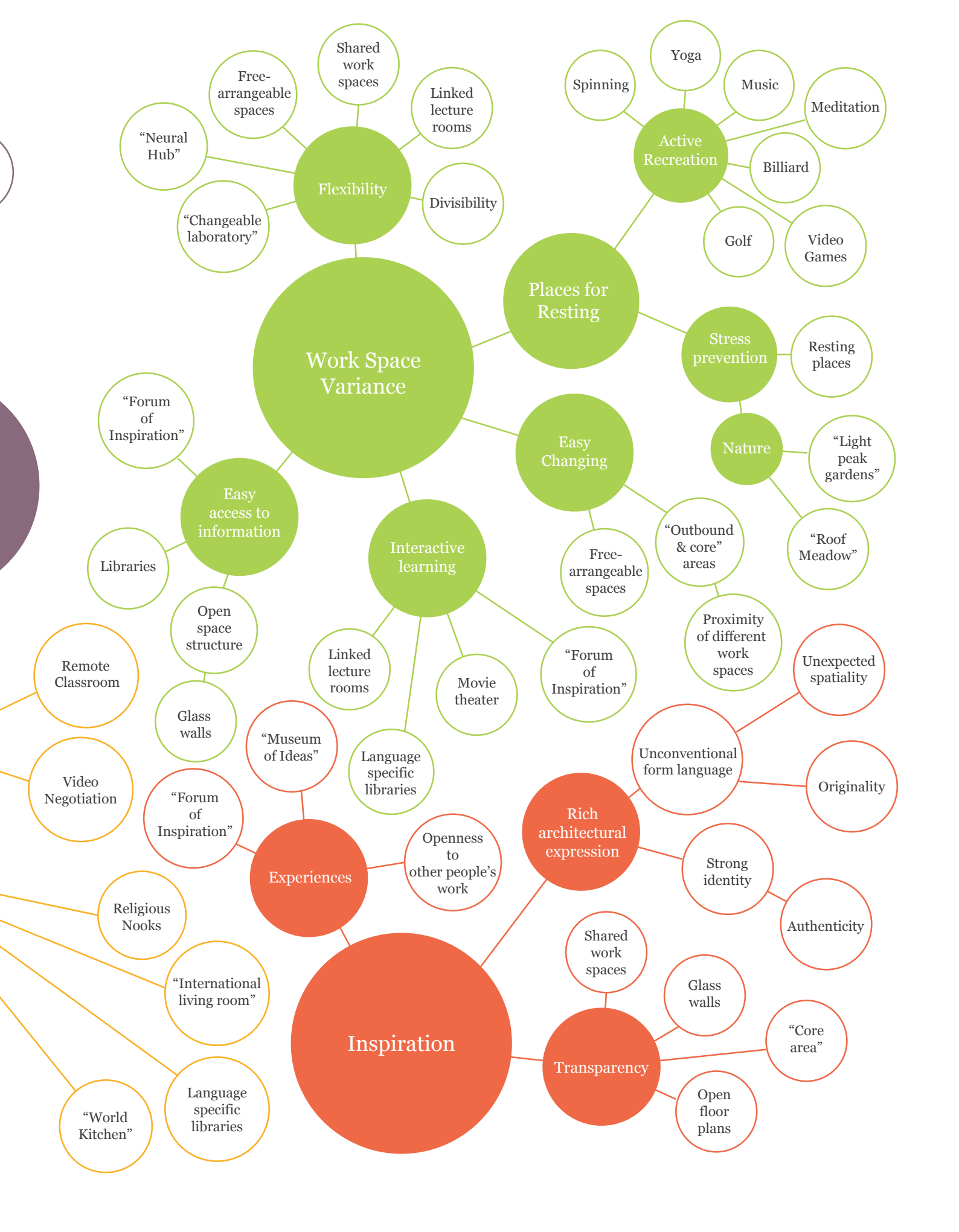


For these reasons, promoting interaction is taken as another major goal of the design. It is supported widely between different people; students and academic staff from different cultures and faculties and from both education and business fields. The means of interaction aim at ***functionality***.

Finding ***relevant space functions*** to actively attract people from different backgrounds has been one of the priorities. The needs of different people have been meticulously considered as well as the beneficial arrangement of the spaces they are likely to use.



A GRAPH OF
DESIGN SOLUTIONS
according to the five principals of the concept


Work Space Variance
Flexibility
Shared work spaces
Free-arrangeable spaces
Linked lecture rooms
"Neural Hub"
Divisibility
"Changeable laboratory"
Places for Resting
Active Recreation
Yoga
Spinning
Music
Meditation
Billiard
Golf
Video Games
Stress prevention
Resting places
Nature
"Light peak gardens"
"Roof Meadow"
Easy Changing
"Outbound & core" areas
Free-arrangeable spaces
Proximity of different work spaces
Interactive learning
Linked lecture rooms
Movie theater
"Forum of Inspiration"
Language specific libraries
Easy access to information
"Forum of Inspiration"
Libraries
Open space structure
Glass walls
Remote Classroom
Video Negotiation
Experiences
"Museum of Ideas"
"Forum of Inspiration"
Openness to other people's work
Religious Nooks
"International living room"
Language specific libraries
"World Kitchen"
Inspiration
Rich architectural expression
Unconventional form language
Unexpected spatiality
Originality
Strong identity
Authenticity
Transparency
Shared work spaces
Glass walls
"Core area"
Open floor plans

5.1
THE **CONTEXT**

Tampere

UNIVERSITY OF TECHNOLOGY

(TUT)

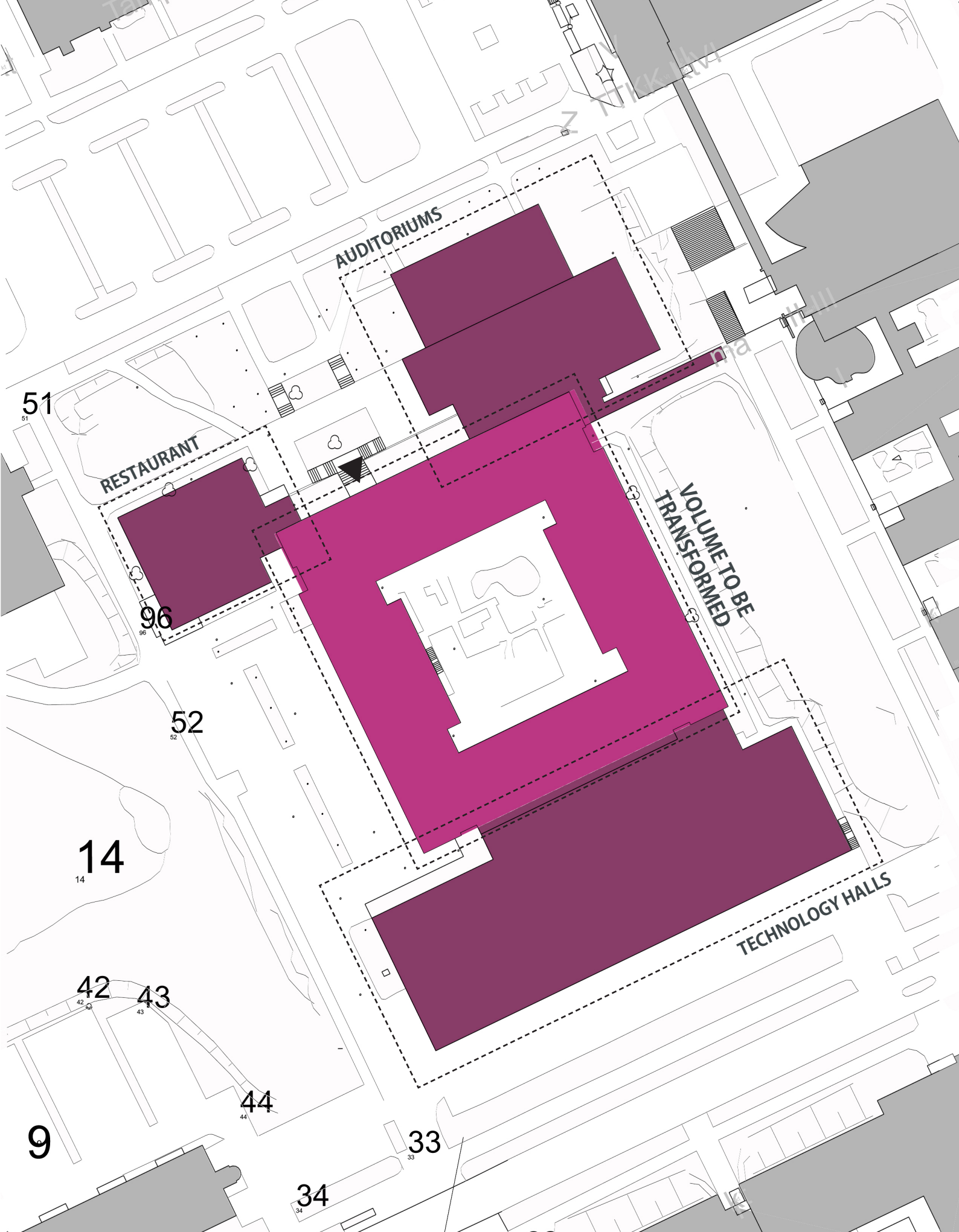
Tampere University of Technology (established in 1972) is the second largest Finnish university of engineering sciences. TUT conducts research in technology and architecture by 20 departments which of each include one or several academic disciplines. The university has a strong tradition of research in the fields of natural sciences and engineering.

Tampere University of Technology is located in Hervanta, the biggest suburb of Tampere. The campus forms a dense U-shaped whole around a central yard. The campus area is surrounded by housing and service facilities from its Eastern and Western sides. On the South, the campus is situated close to Hermia Technology Centre, a business park of several technology companies. VTT Technical Research Centre of Finland is located to the North of campus. A new campus supplement, the Campus Arena building, will be completed in 2015.

Internationality presents an important value of TUT with 1,500 foreign nationals working or studying from more than 60 countries. The university is also well known for its strong student culture. Student Union possesses dozens of sub organizations such as guilds and student clubs that act in various fields. (www.tut.fi, www.ttyy.fi)

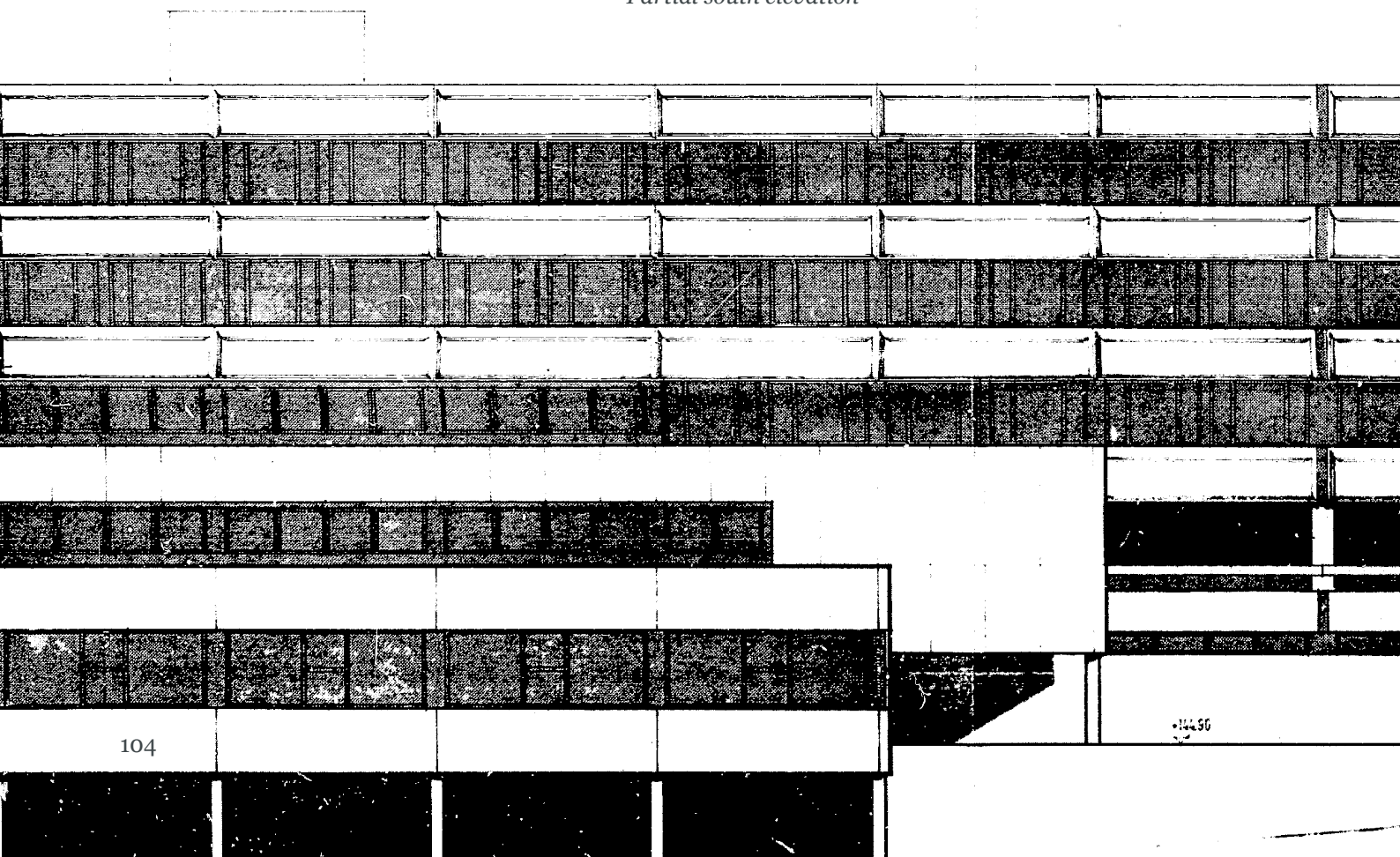
TUT could be seen as an optimal target for experimenting creative, research based learning environment in many ways. First, Technical Universities are one of the most important possible innovation producers of the modern society. Research has always had a strong role in TUT's strategy, and the campus possesses various kinds of expertise fields in a dense entity. The close proximity of TUT and Hermia Technology centre could be compared to the positive situation that Stanford University had with the Stanford Industrial Park in the early times of Silicon Valley.

^TUT campus & surroundings Konetalo 1:1000 >


AUDITORIUMS
RESTAURANT
VOLUME TO BE TRANSFORMED
TECHNOLOGY HALLS
51
96
52
14
42
43
44
9
33
34

TUT:
Konetalo

Partial south elevation



Konetalo, the building where the design is retrofitted, was the first and for long the only building in the campus area. Built in 1973, it was designed by a Finnish architect Harry W. Schreck. Besides Konetalo, Schreck is known as a designer of many other public buildings in central locations in Tampere, such as of various schools (Tampere Normal School, Hervanta High school, Elementary school of Olkahinen) and for example the swimming centre of Pyynikki. With its narrow window strands, Konetalo is a strong architectural representation of its era.

Konetalo borders the central yard of the campus from the North. Its central location enables easy access from other parts of the campus, although its main entrance remains distant to the street line. As for its situation next to the Hermia Technology Centre, Konetalo can be seen as a potential link in combining campus and business functions.

Konetalo is occupied by staff and students from different technology departments, the biggest being faculties of production, automation, mechanical and materials engineering. The current space structure consists mainly of faculty specific laboratories, seminar rooms and offices. The functions common for all the campus users are a restaurant in its basement and a language learning centre on the second floor. Owing to these features, there is already a large variety of people present every day. The design has been limited to transform only the centre part of the building, since it possesses all the major learning facilities.

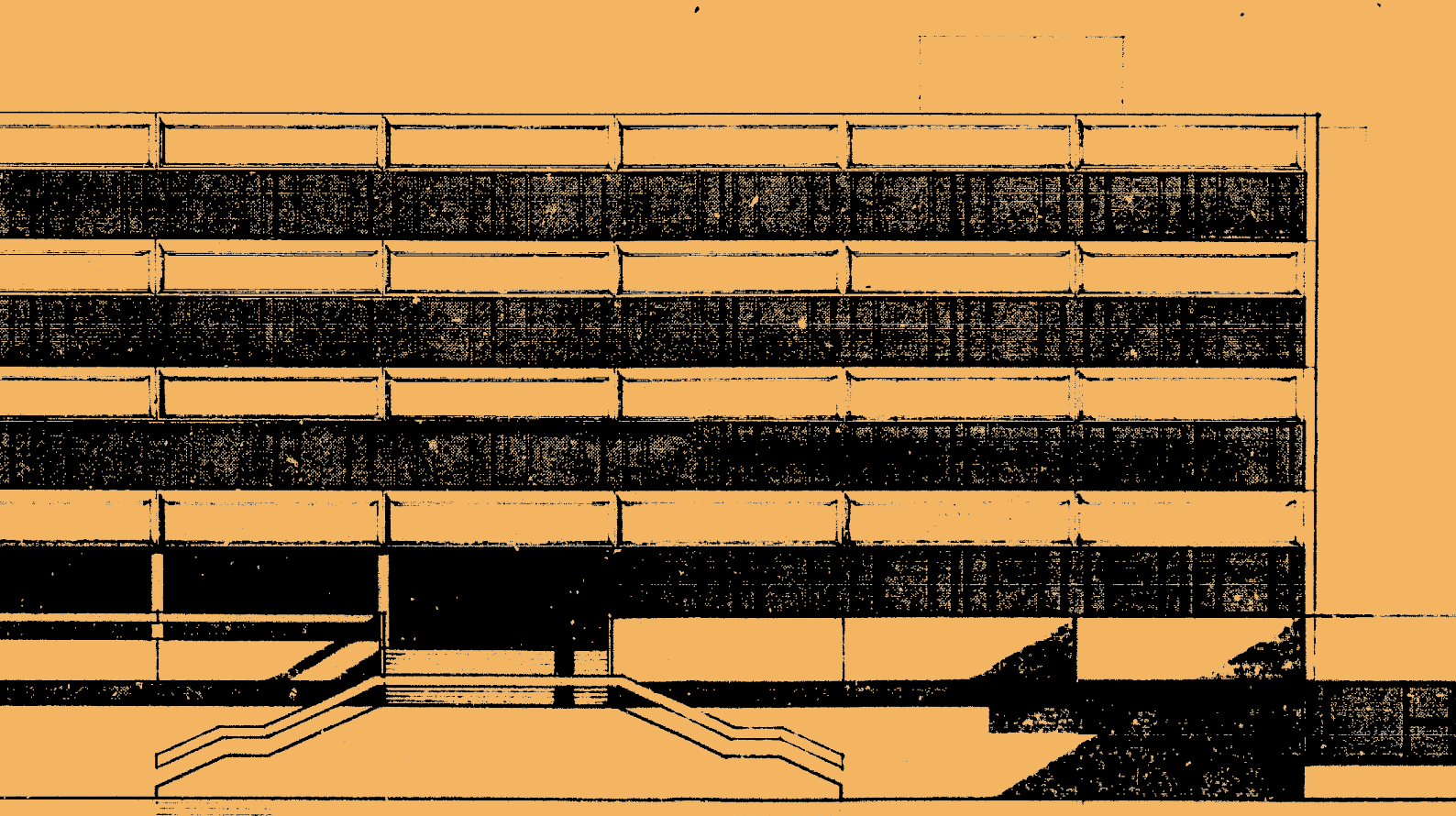


Image: Tampere Building Control Department

Konetalo, 1st floor 1:1000

Office

Lecture room

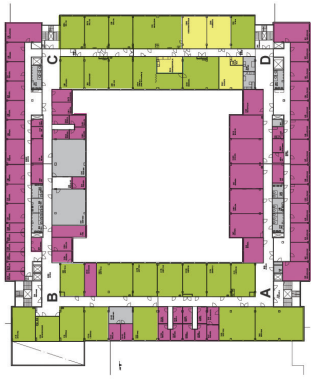
Student Club

Researcher room

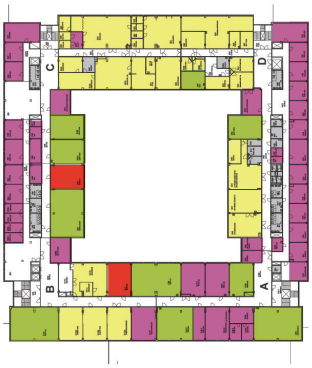
Laboratory

Supporting

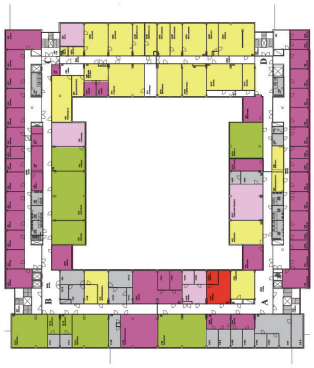
Images: Tampere Building Control Department



2nd floor



3rd floor



4th floor

Current FLOOR PLANS

Although respeced for its historical value, the age of the building leads nowadays also into many confrontations. Spaces are designed to support outdated learning methods. They are named for specific, traditional usages such as “lecture hall”, “seminar room”, “laboratory of plastics” or “laboratory of coating testing”. Spaces show a little versatility or flexibility from their designated functions.

Spaces are cellular in their nature and situated in rows. In many occasions there are even three space rows in a wing which has obliged to double corridor solutions. Since both outer and inner outbound of the building are rounded by rows of closed spaces, the corridors obtain no sunlight or views outside. That causes also the inner yard to remain anonymous and widely unused. Floor plans follow the same pattern through all the levels, which makes the floors seem monotonic. Double corridors and the repetitiveness of floor plans set no easy start for spatial orientation.

< *Konetalo from the South. The construction site of the new Campus Arena on the front of the image.*

⌞ *The inner yard of Konetalo remains unused most of the time of a year. There are no visual connections from public spaces, except from few spots in the first floor.*


KUITUMATERIAALITEKNIIKKA

The multiplicity of corridors dominates the character of interiors

5.2 MAIN CHANGES

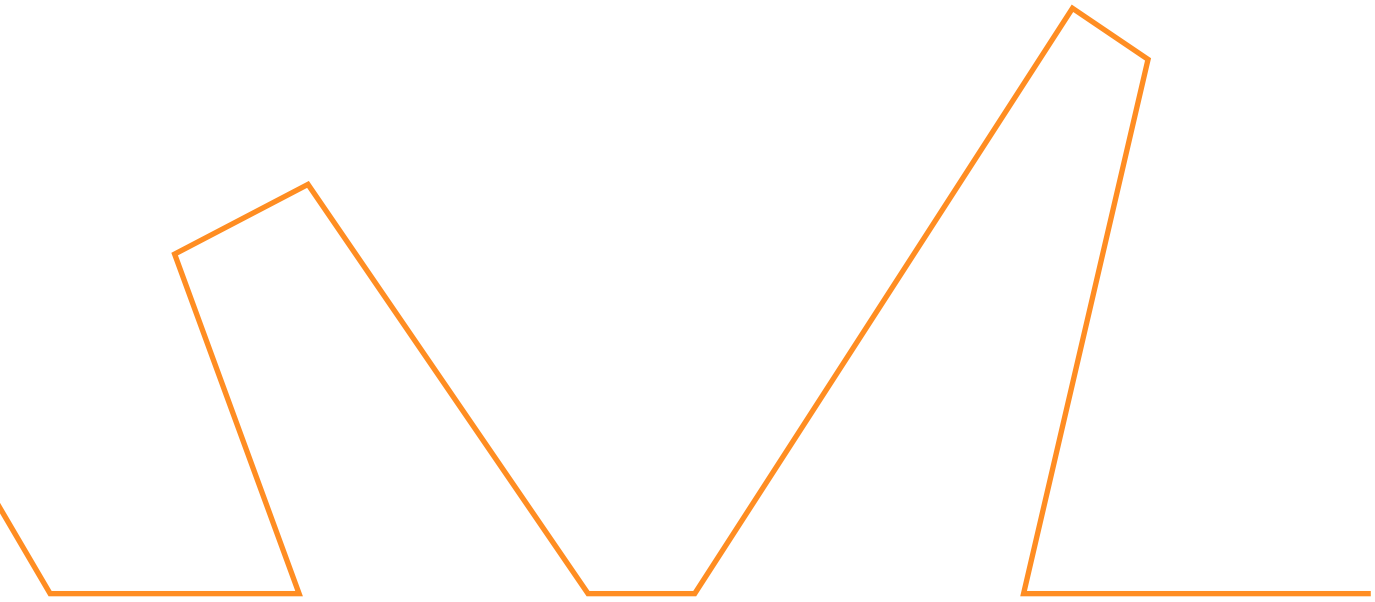
The architectural form of new parts creates a strong contrast between the new and the old structures. The selected architectural expression aims at creating a strong identity for the building through originality. The unconventional form language aims also to provide interiors with unexpectedness and unique spatial experiences.

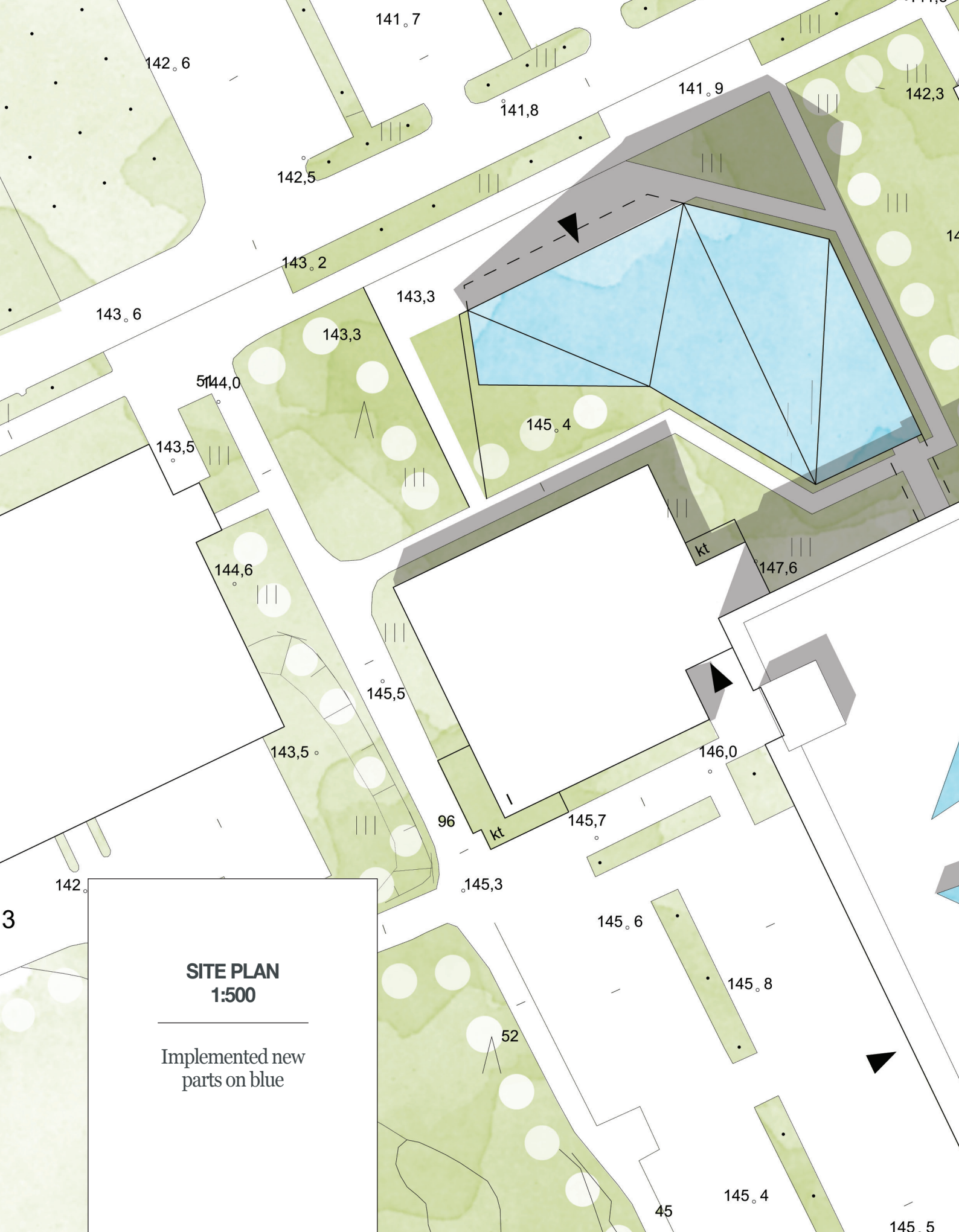
The design leaves building's external parts mostly untouched. This is both for the emotional respect for the historic building and a conscious decision to treasure authenticity. The changes are directed to the ***interiors*** and to a new ***annex part***.

“

Unconventional architectural expression

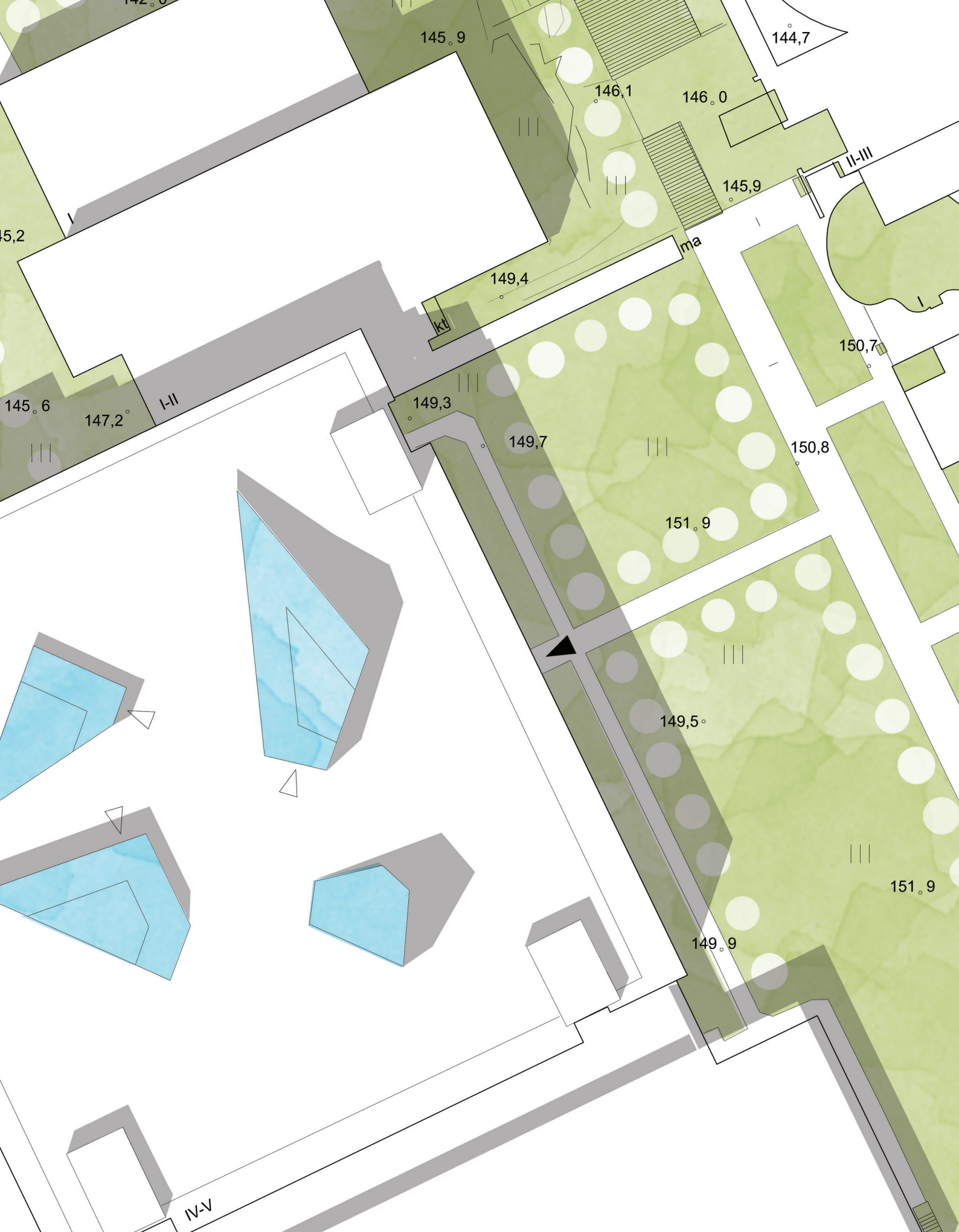
aims to provide interiors with unexpectedness and unique spatial experiences





SITE PLAN
1:500

Implemented new parts on blue


145,9
144,7
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II-III
145,9
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I
ma
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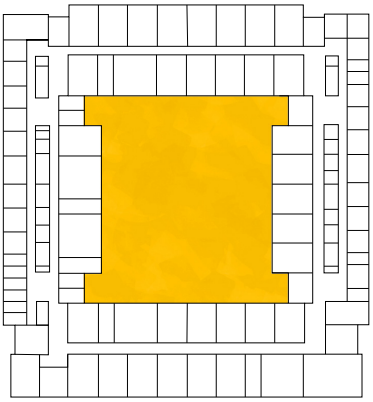
I
150,7
145,6
147,2
I-II
149,3
149,7
150,8
151,9
149,5
151,9
149,9
IV-V

Volume
TREATMENT

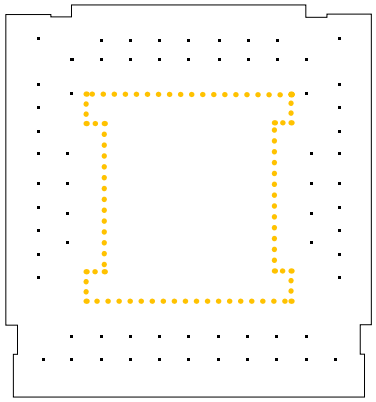
1



Joining inner yard

To demolish all the elements restrictive to a free flow of people, an inner yard has been added to interior spaces. The floor slabs extend to central space at each floor level, which increases the floor area.

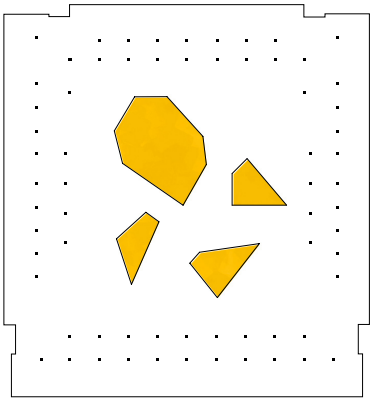
2



A clean up

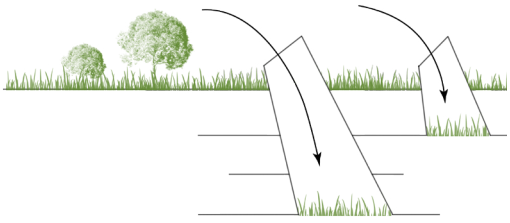
All non-bearing structures are demolished in order to enable a new open space structure.

3

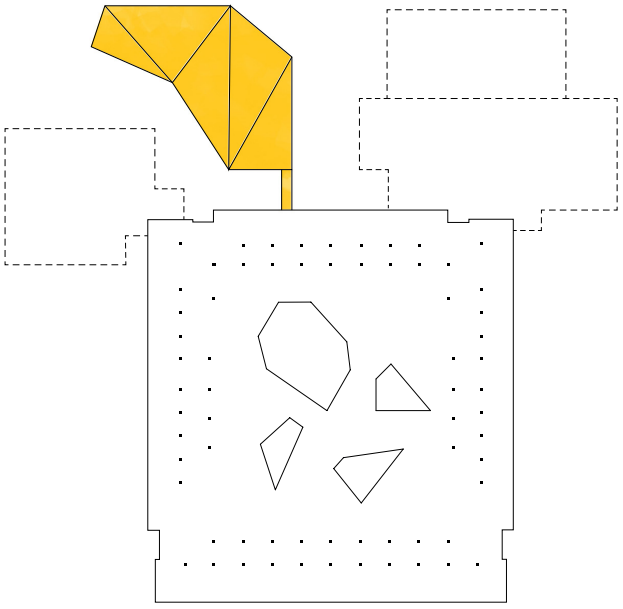


Opening vertical connections

To obtain natural light to the central areas, four light peaks are created.
The new roof meadow extends to the interiors through three of them. Their architectural form acts as a contrasting element towards the old structure. Their borders are used to delineate functions in the core area.



4



The Annex

The annex brings the building closer to the street line which increases buildings's visibility and makes the main entrance easier to find.

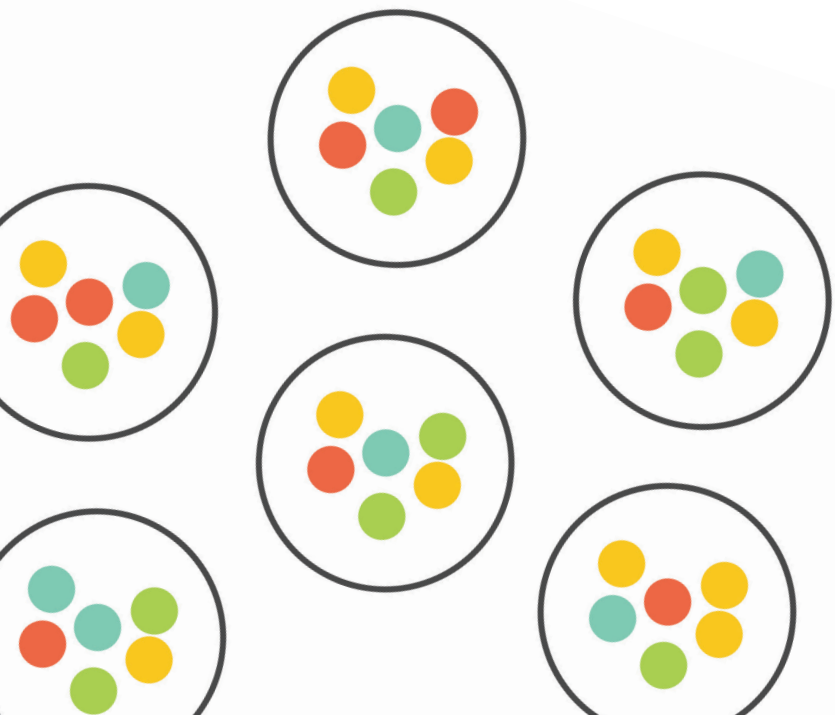
Rearrangement of FUNCTIONS

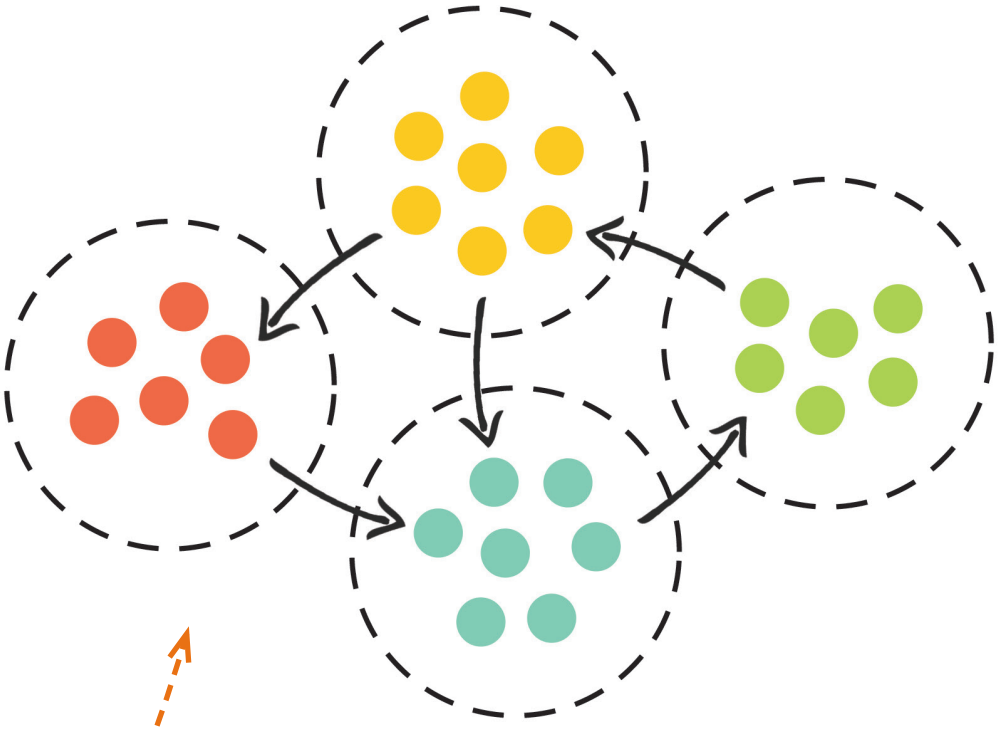
The functions are in the current building are strongly divided according to faculties. Faculties form individual entities within the building, containing miscellaneously private lecture halls, laboratories and office spaces.

The current space order enables interaction among the students and staff within same units, but it doesn't promote interaction with people from elsewhere. Inside a unit the influence of conventional ideas and methods that "have always been" is strong and it is hard for novel, radical influences to break through.

Except for a restaurant in the basement, a cafeteria, and the language learning centre, people from other environs don't currently have much reason to come to the building. This is all detrimental for the aim of bringing large divergency of people together to exchange ideas.

From units to ***communities***





The new arrangement is accomplished by distributing functions

according to floor levels

so that each of them comes to possess a specific theme essential to creative work.

The design changes the situation by rearranging functions. The new categorizing connects people not according to expertise fields, but to their expertise levels, points of interests and working process phases. In other words, connects people from diverse backgrounds that are likely to get into a functional interaction with each other.

New spaces are designed to be used flexibly by all people across the expertise borders. This kind of multiuse boosts also space efficiency and liberates floor space, which enables to increase the variety of spaces.

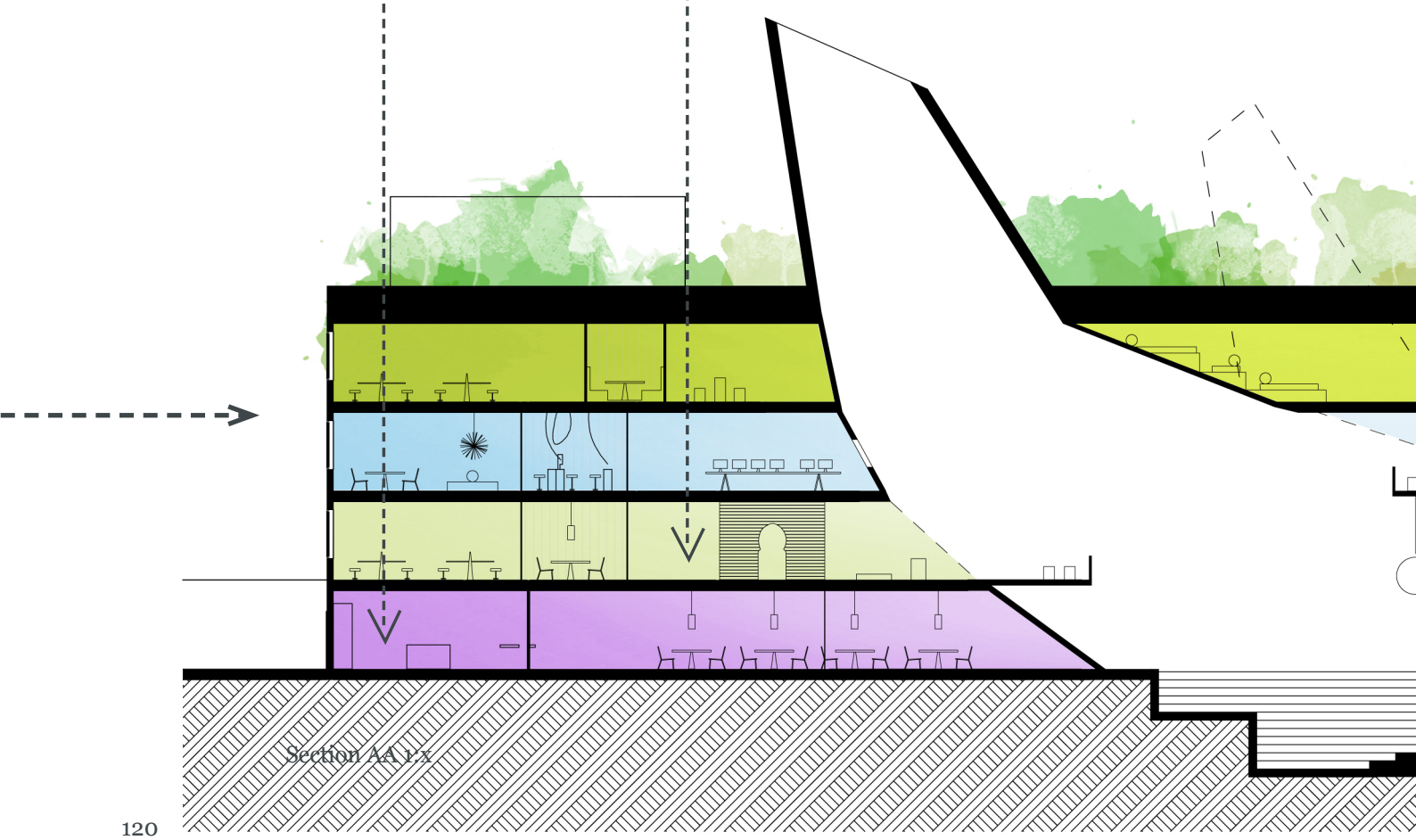
The theme
floors

1. FLOOR
COLLISION OF IDEAS

The first floor blends students, researchers and teachers from all over campus as well as business people from Hermia Technology center

2. FLOOR
INTERNATIONALIZATION

Second floor blends cultures and languages. Foreign students and staff meet with their Finnish peers, which develops language skills at the same time.



Section AA 1:x

3. FLOOR
IDEA FARMING

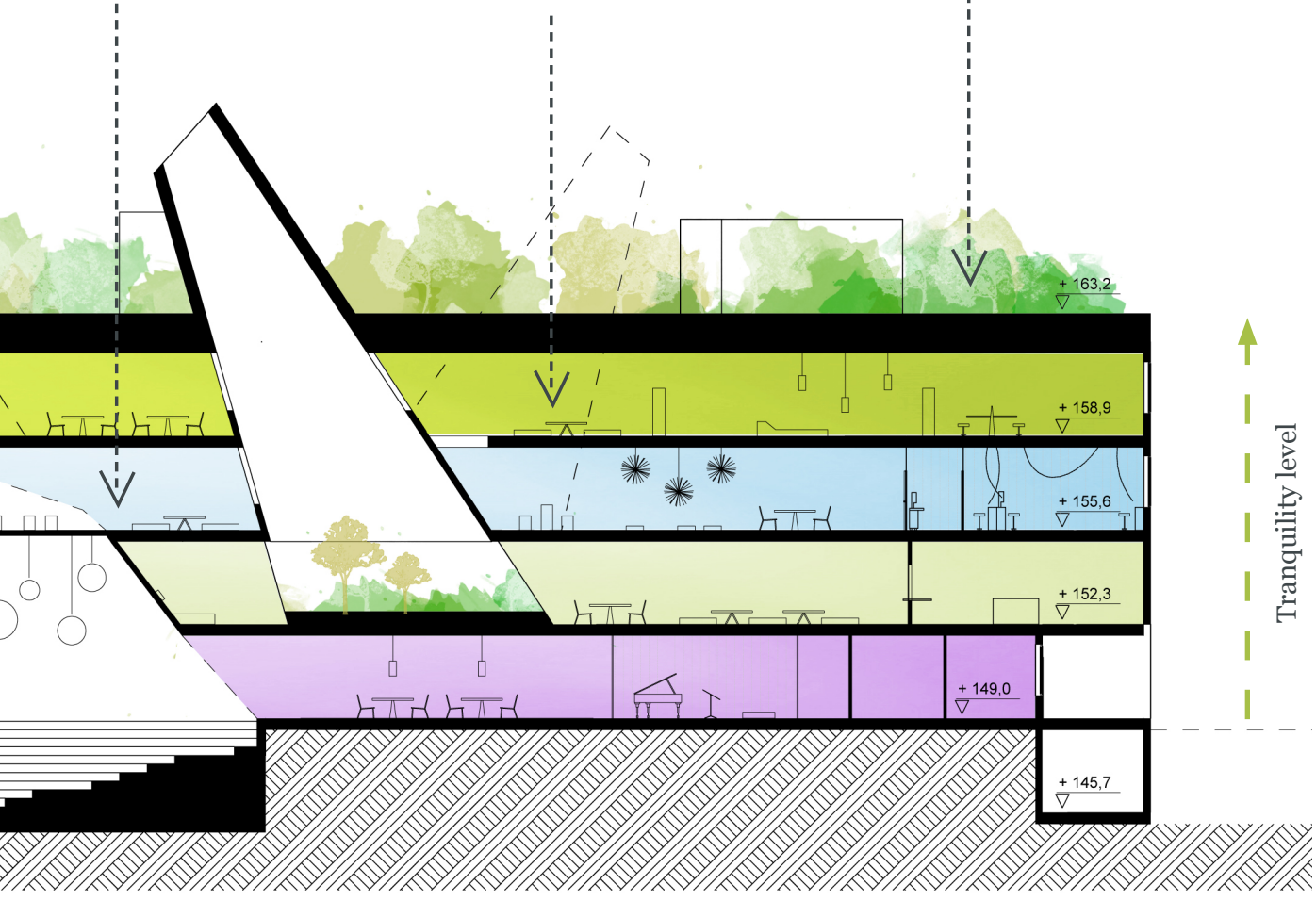
The third floor offers spaces for assembling new knowledge as well as spaces for testing and developing innovations

4. FLOOR PROFESSIONAL CORE

Exciting work facilities for academic staff have been created to the forth floor where students have only restricted access.

5. FLOOR
ZEN AGAIN

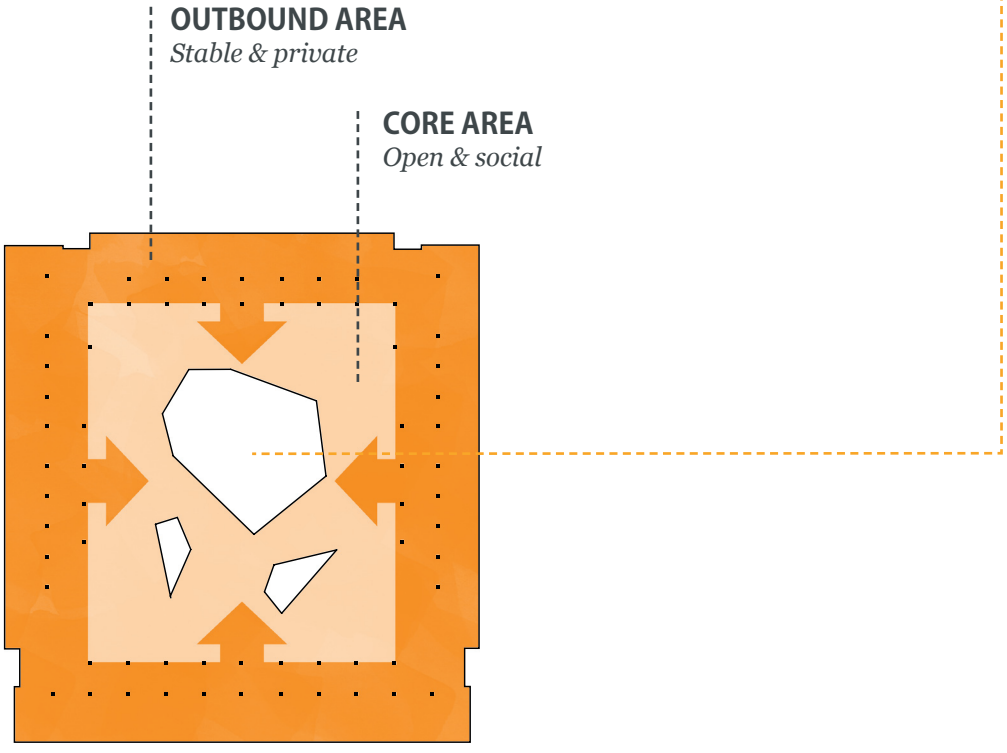
Creative ideas cannot be born when one is too tired or stressed. On the roof there is a meadow and places where to rest and escape from the pressure.

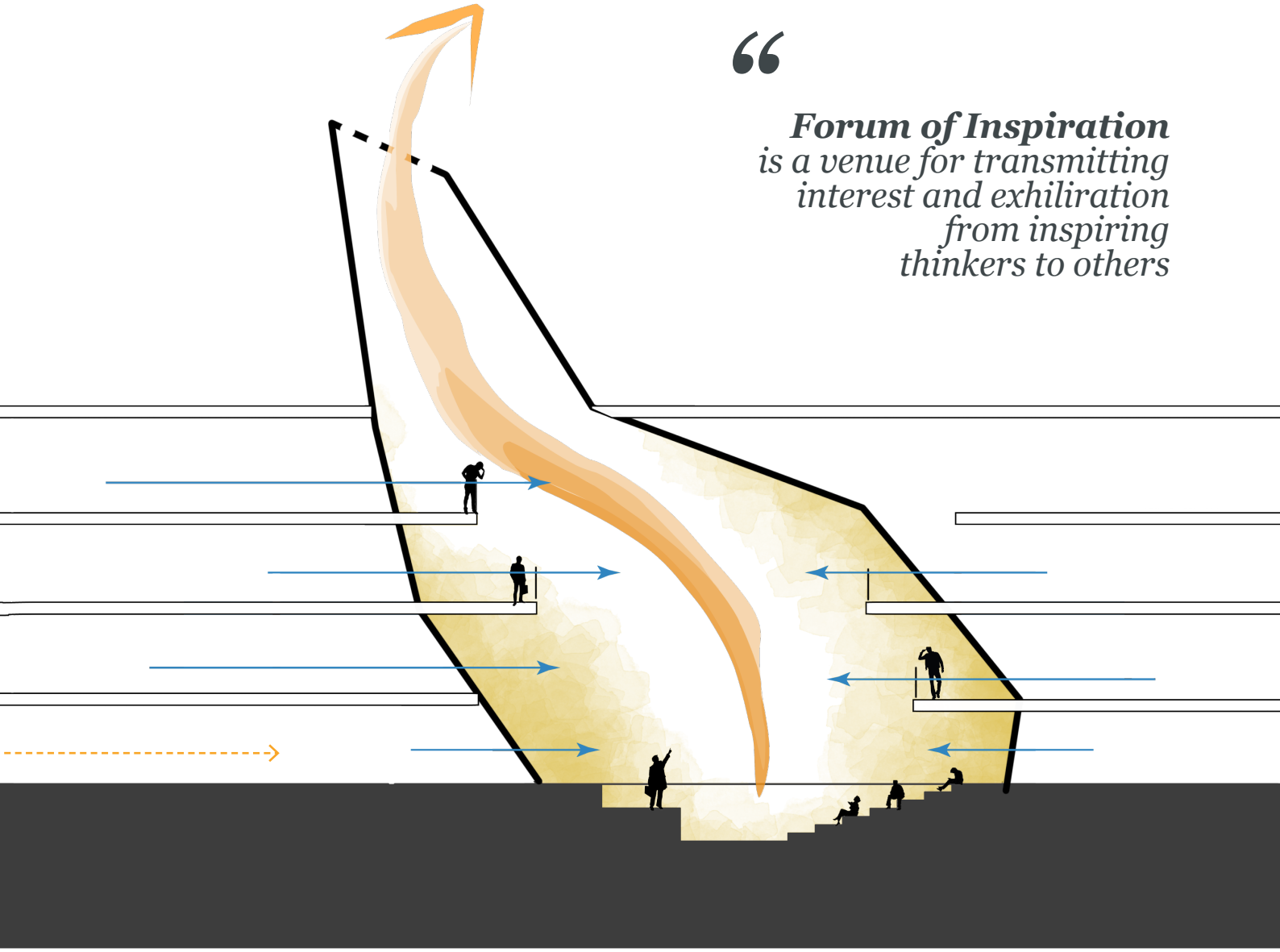


REARRANGEMENT OF

floor plans

The floor plans follow parallel basic principles in each floor. The outbound areas hold functions that are stable and need more privacy. The outbound areas open towards the core areas which are formed between vertical light peaks. They are places for blending, social interaction and informal activities. The spaces in the core areas are easy to take over and rearrange according spontaneous needs. This division enables users to ***easily change between*** the different work methods and groups.





> ***Forum of Inspiration*** *is a venue for transmitting interest and exhiliration from inspiring thinkers to others*

Forum of Inspiration, the main one of the light peaks, forms both physical and conceptual core of the design. It is dedicated to raise inspiration and intrinsic motivation; the fundamentals of creative working.

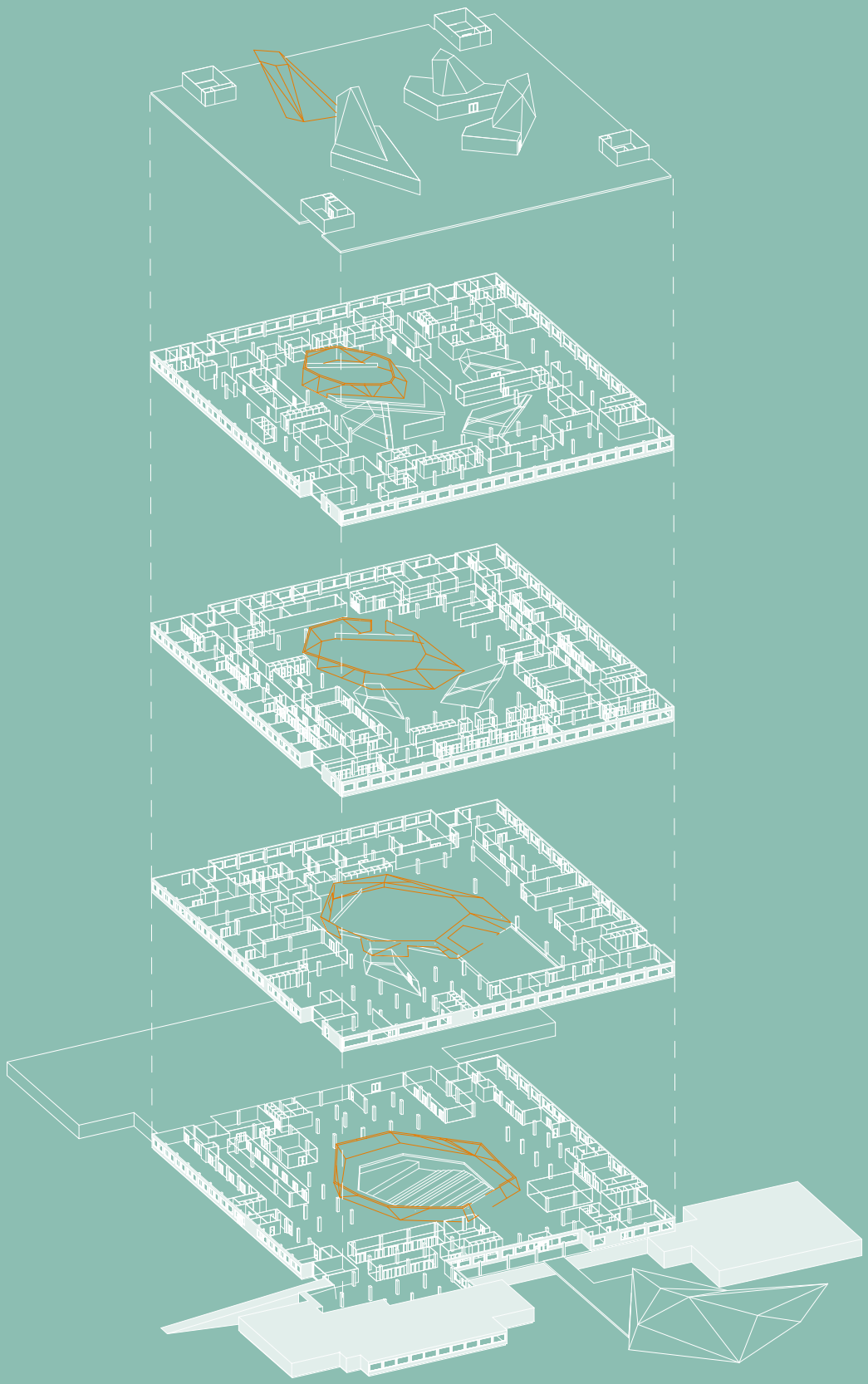
Forum of Inspiration is a voluminous speech hall that stretches vertically through the whole building. As it forms the heart of every floor its events can be spontaneously participated and followed from each of them.

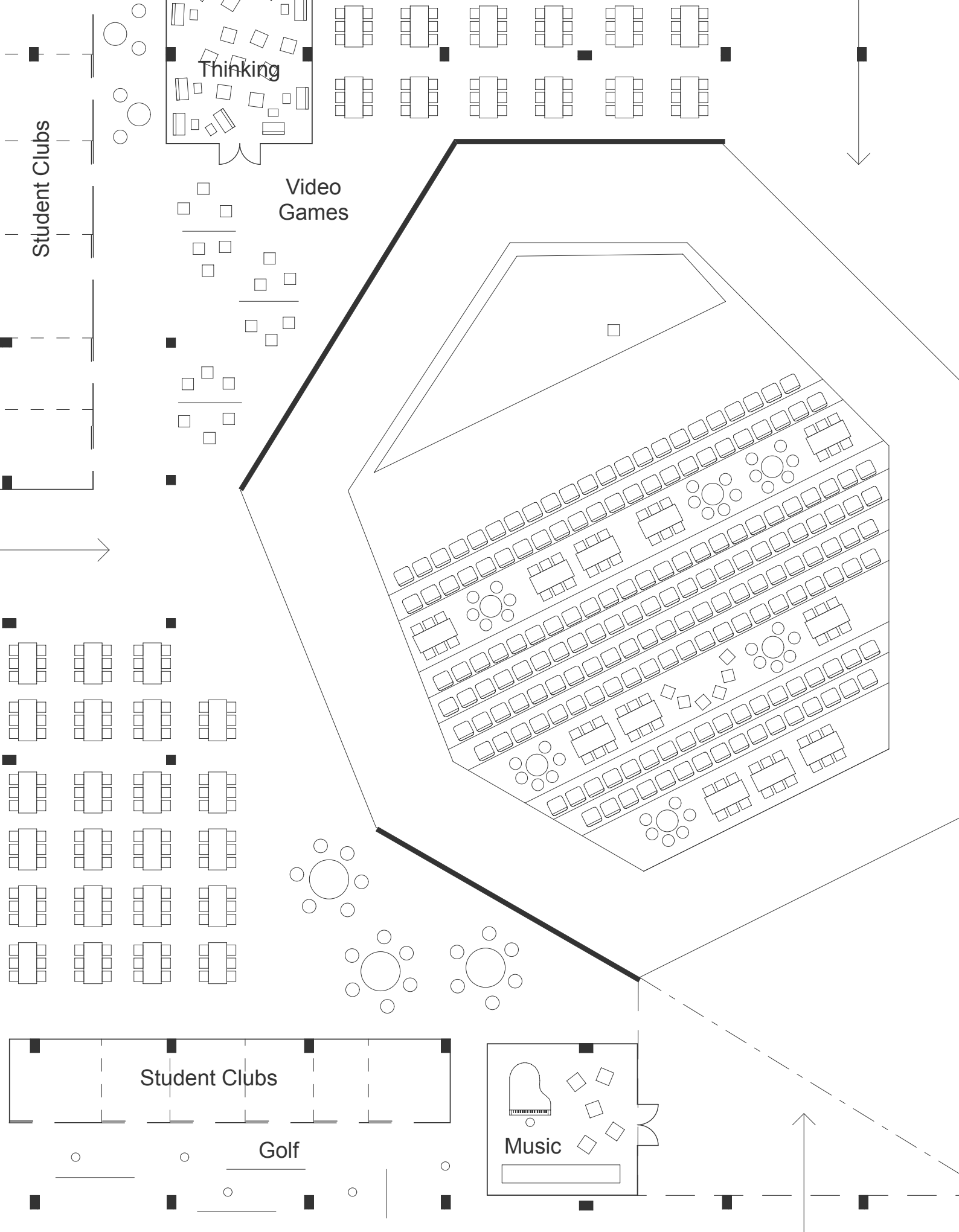
Forum of Inspiration offers a mean for transmitting exhilaration from fascinating thinkers to others. It is an arena where talented speakers from the TUT, other Finnish universities or abroad introduce interesting themes and current topics for wide ranging audience. Beside that, Forum of Inspiration offers a central venue for the campus's public life; for idea presentations, discussions, fairs and workshops.

5.3 INTERNAL **TOPOGRAPHY**

This chapter introduces the design floor by floor.

1fst Floor	*Collision of Ideas*
2nd Floor	*Internationalization*
3th Floor	*Idea Farming*
4th Floor	*Professional Core*
Roof Level	*Zen Again*




Thinking
Student Clubs
Video
Games
Student Clubs
Golf
Music

1st

Billiard

Cookery

STOR

Cold Room

Freezer

Social

WC

Project Nests

Meditation

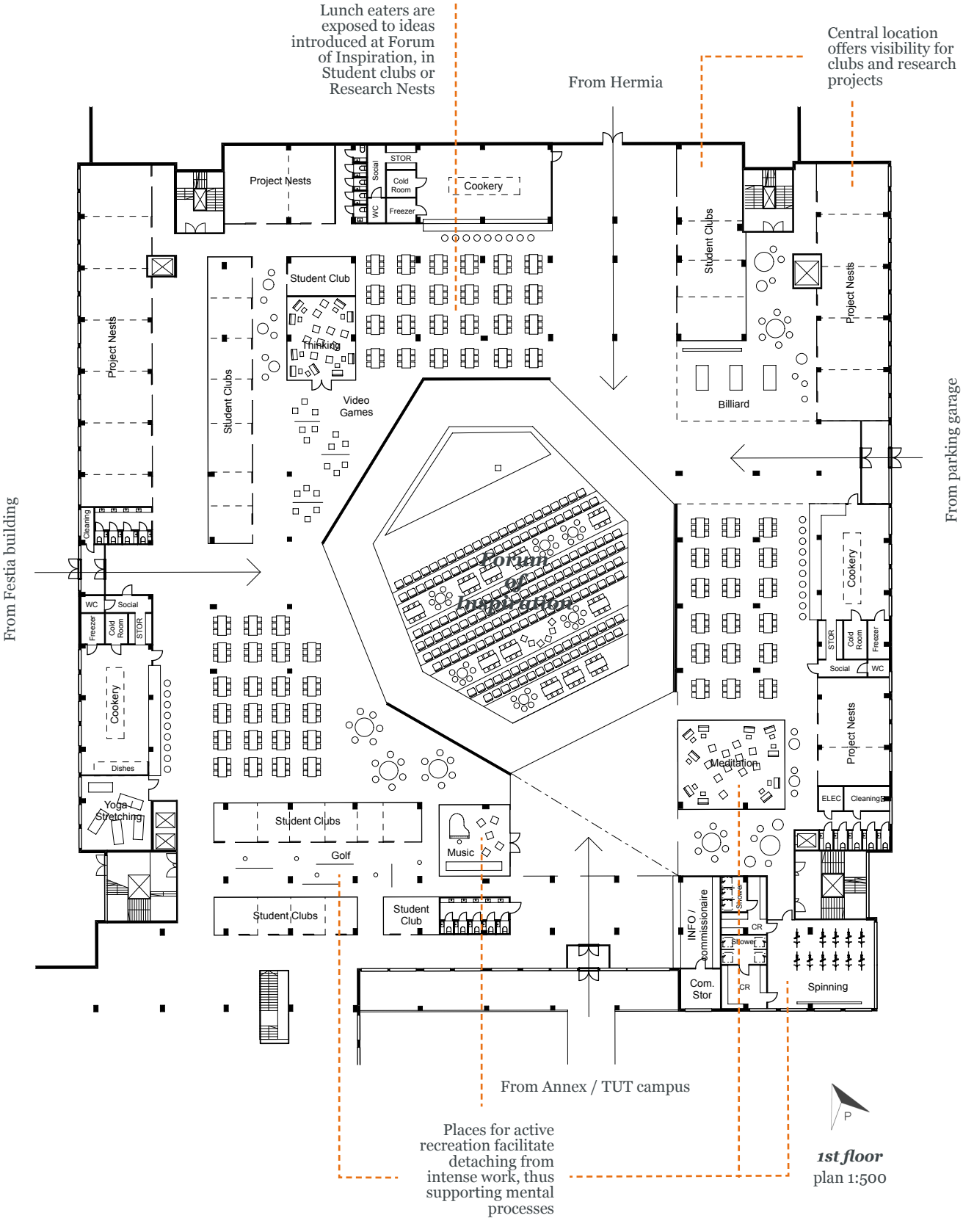
ELEC

Cleaning

COLLISION OF IDEAS

1st floor

A floor plan fragment
1:200



1st floor
plan 1:500

Of all the floors of a building, the first ones are those where most of its users pass by. In the design, this is used as an advantage by dedicating the first floor to lure diverse people and promote serendipitous encounters of their ideas. The chosen space functions aim at ***clustering people with parallel interests*** in order to form intellectual networks. The functions are ***placed*** so that their visibility maximizes, and can so catch spontaneous attention and interest from people passing by. The floor is ***opened from all its sides*** in order to welcome people from all directions.

Three new themed ***restaurant points*** (1) serve lunch for people coming not only from the campus, but also from Hermia. When coming to the Idea collision floor they are exposed to various ideas that can raise their interest to collaborate and make contact with students. Restaurant kitchens are maintained from the existing restaurant kitchen in the basement.

Student clubs (2) are cornerstones of TUT's social culture. They also possess a great potential for forming intellectual networks *by their natural tendency of driving together people with same interests*. However, currently situated in low profile places of the campus such as in basements, they are likely to remain inconspicuous to the public. In this design their role is emphasized by placing them together in sight.

Research Nests (3) are situated at the outbound of the floor. They are places for temporary, collaborative research projects of researchers, students and businesses from diverse faculties and nationalities.

The close proximity of clubs and nests enables their reciprocal interaction and change of ideas. For that matter there are also group working areas placed between them. Constructed with ***glass walls***, they act as display windows of interesting, diverse subjects that raise curiosity and interest in the passers-by. The premises of both clubs and nests are ***flexibly divisible*** according to their space needs so that they can be easily adjusted and reformed during their lifetime to serve different needs.

> *"The aim of the chosen space functions is to* ***cluster people with parallel interests***

The importance of ***detaching places*** (4) has been discovered earlier in this study. The first floor offers a large variance of them. Yoga, spinning, video games, indoor golf, music, billiard and meditation rooms aim to support diverse lifestyles and preferences of users. Being exclusive in the campus, also they are likely to attract people from everywhere. Like the student clubs, these activities are also features that inherently collect people with same interests or lifestyles together.

The ***Forum of Inspiration*** (5) forms the core for the whole floor. Everybody present in the floor is exposed to its interest raising influence; lunch eaters, club and research groups members and people arriving to detach from their work.

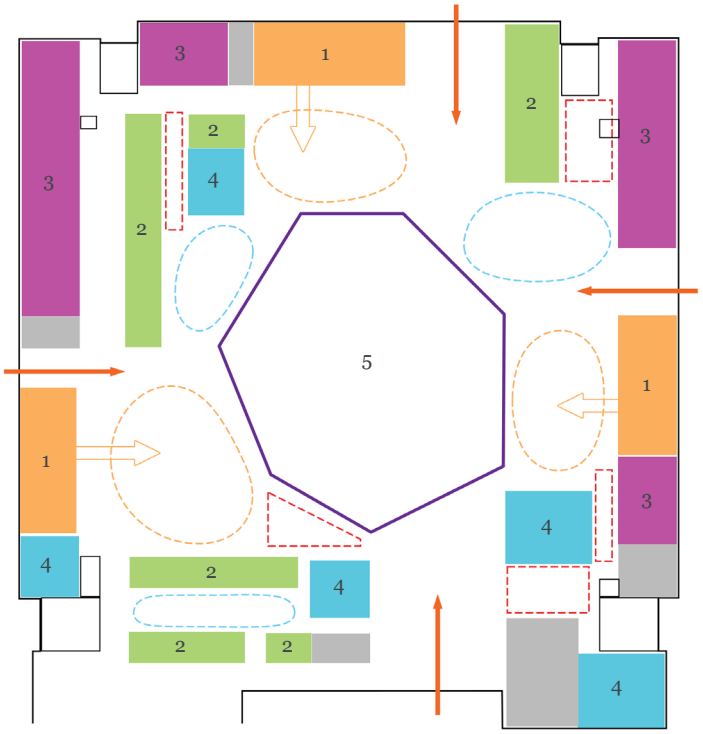
The operational goal of the first floor could be thus concluded as follows:

Restaurants, detaching places and the events at Forum of Inspiration are aimed to attract people from diverse sources and make them to blend with each other. Once present, they are exposed to inspirational influences by perceiving talented speeches, new ideas, interesting research topics and club activities. Student clubs, theme restaurants and detaching places have inherent tendency to cluster people with parallel interests and therefore assist the forming of intellectual networks. The spaces are placed loosely and mixed so that they can all be easily perceived.

Entrance hall:	445 m²
Forum of Inspiration:	877 m²
Project nests:	529 m²
Student clubs:	378 m²
Restaurants:	1189 m²
Detaching places:	749 m²

Commissionaires:	45 m²
Electric centre:	5 m²
Cleaning:	10 m²
Toilets:	75 m²
Business premises (annex):	1132 m²
Museum of ideas (annex):	232 m²

Index:



Student club

Project nest

Restaurant point

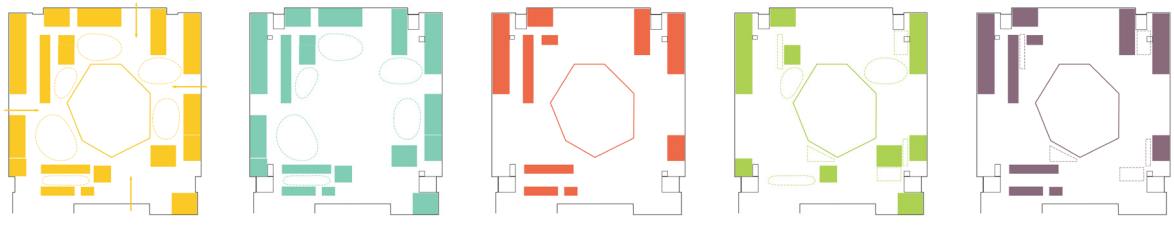
Dining area

& *Detaching*

Supporting functions

Interdisciplinary group work

Forum of Inspiration



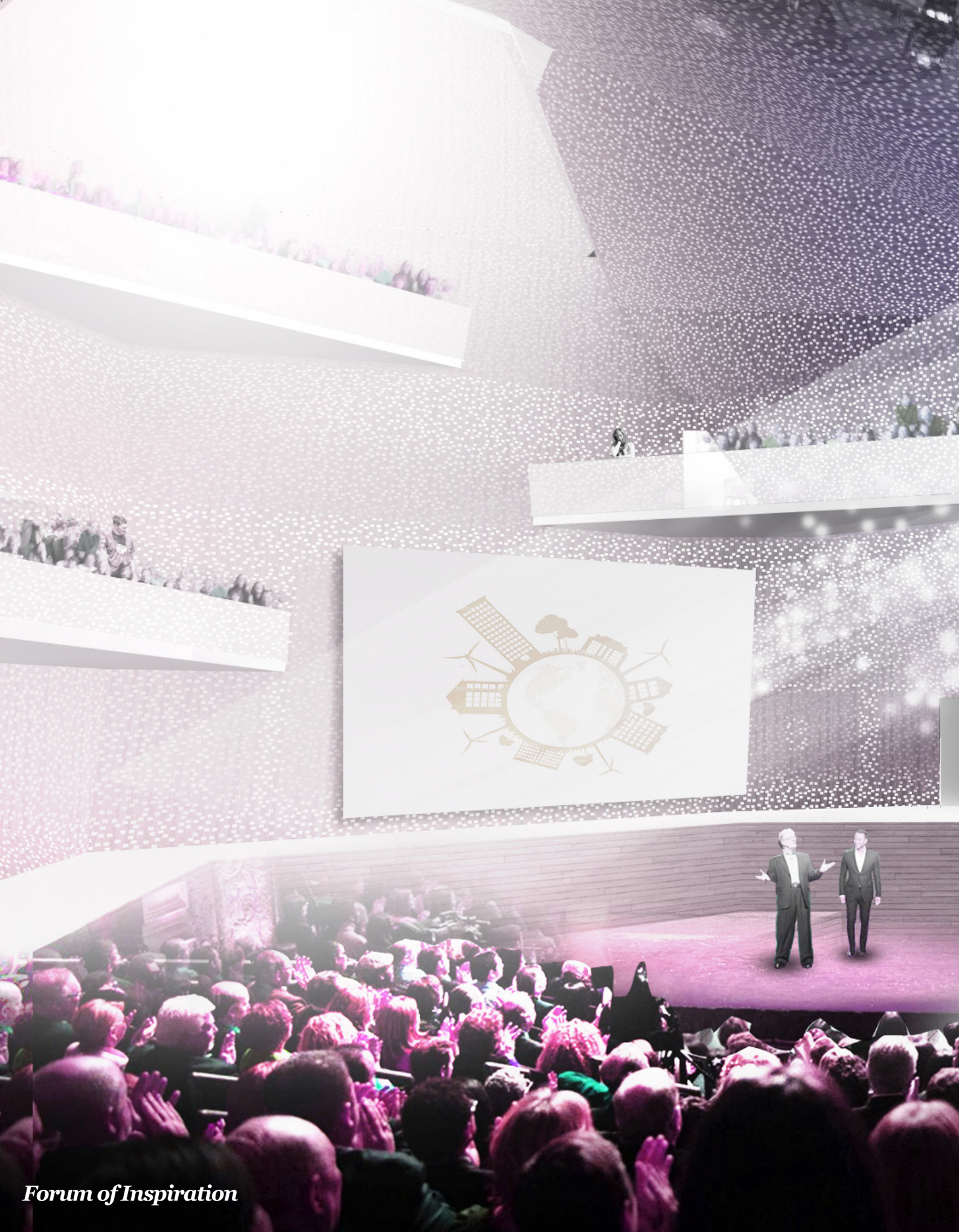
Openness & Diversity

Coherent grouping

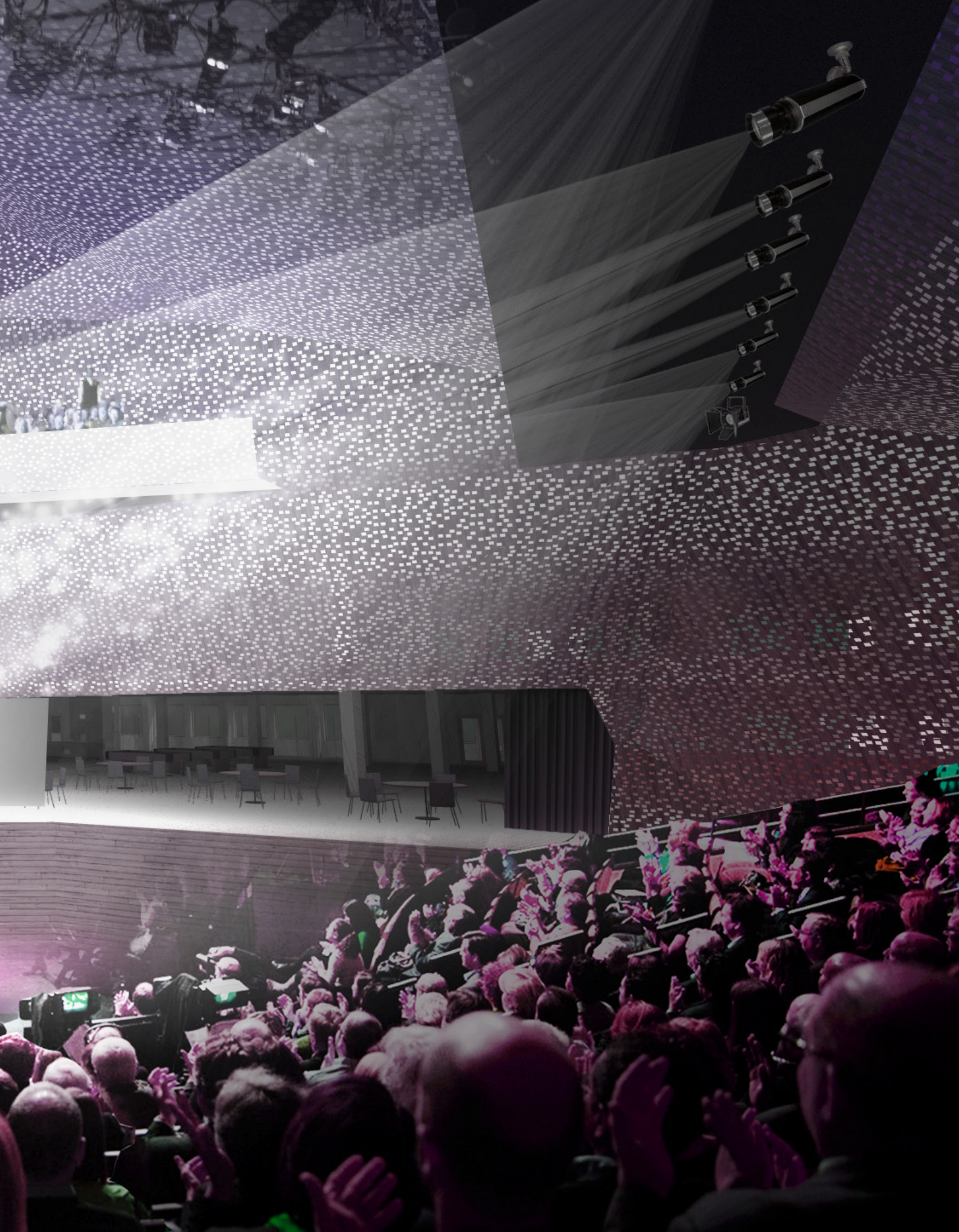
Inspiration

Work Space Variance

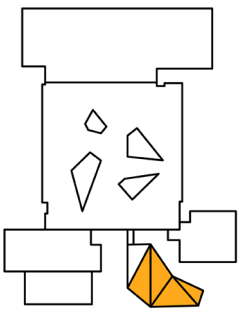
Means of Realization



Forum of Inspiration

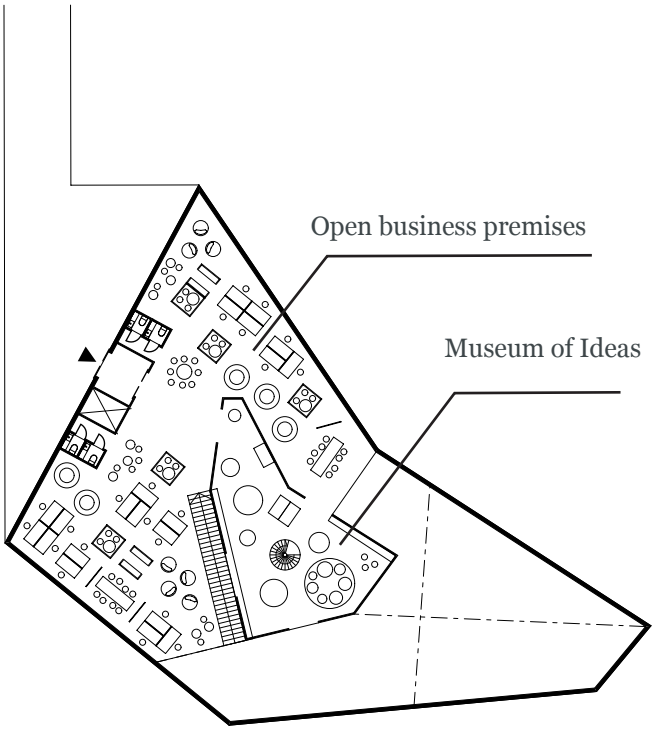


the Annex



Resembling a diamond in its form, the building is complemented with an annex part that links to the first floor. The annex brings the entrance closer to the street line and to the new Campus Arena building.

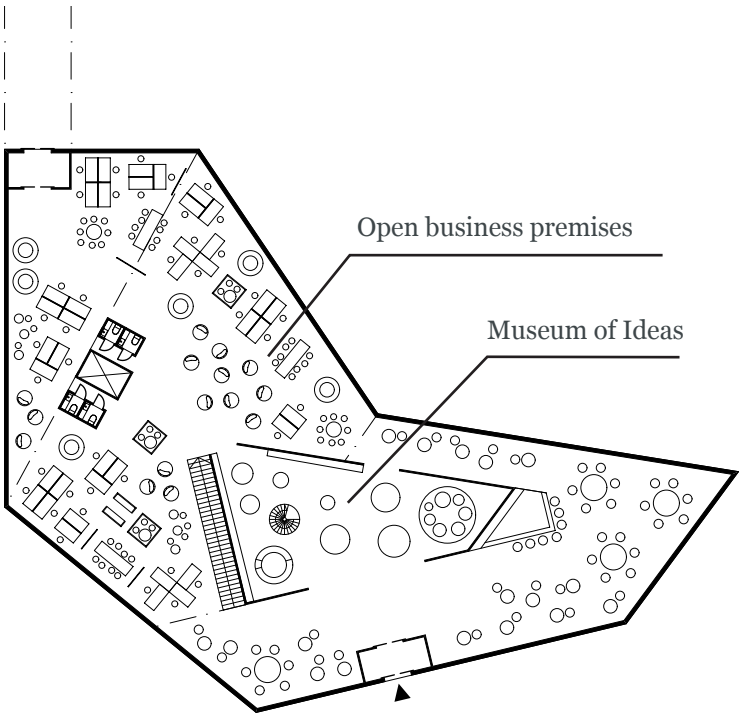
The annex offers ***means for realizing*** ideas. It is intended to work in a same way that Stanford Industrial park's Business Premises established by Frederick Terman. Premises serve for further development of the most prominent ideas,



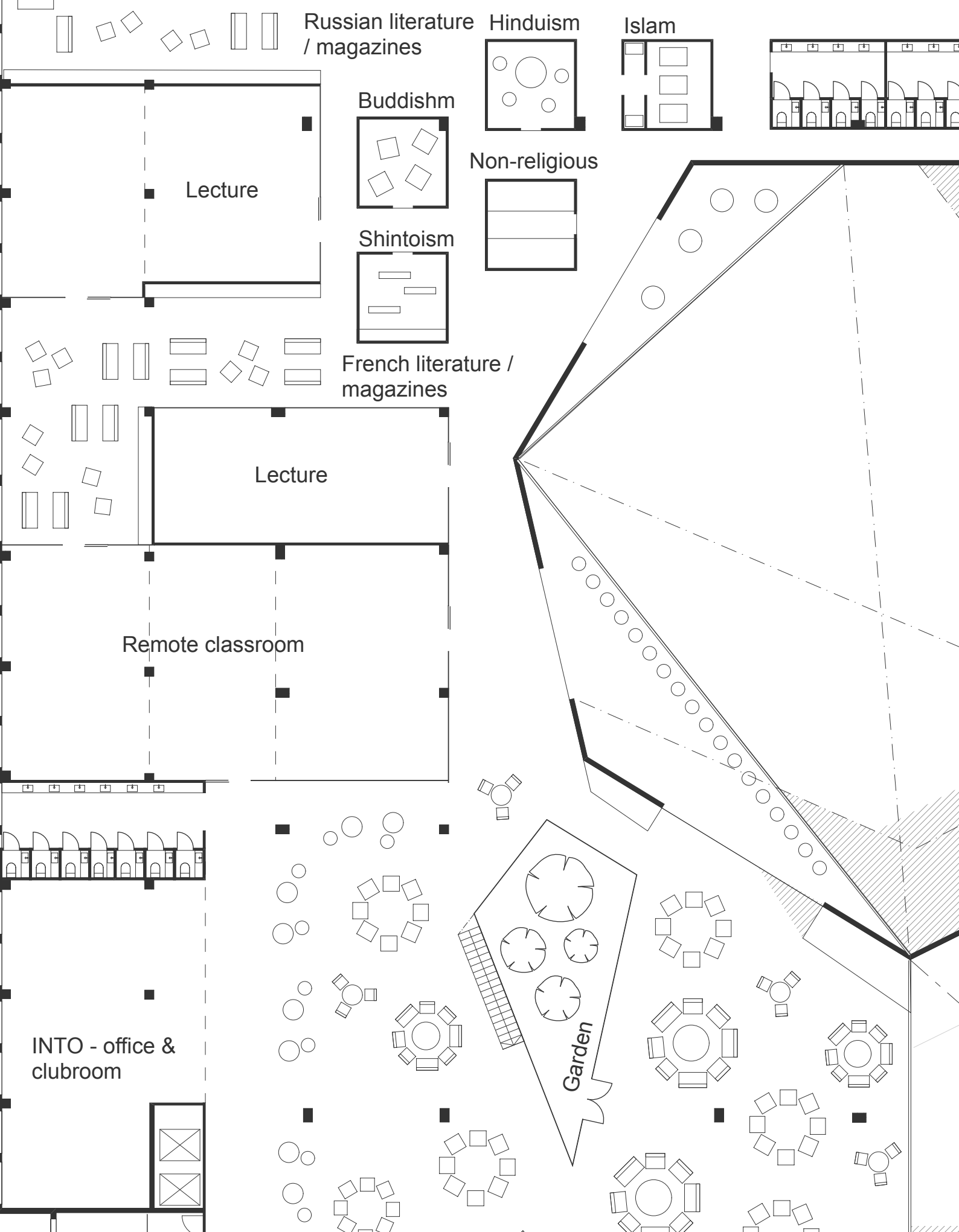
1st Floor 1:500

offering innovative entrepreneurs a chance to rent ***office space*** with extremely low expense. The floor plan is open in order to enable a full ***flexibility level***. This enables free and spontaneous rearrangement of office facilities to correspond to varying sizes and compositions of teams.

In the middle of the annex there is ***Museum of Ideas***, where inspiration can be drawn from an exhibition of early prototypes and rejected ideas. Seeing the ideas of other people works as a inspirational trigger. In addition, the solutions once failed might suddenly suit new contexts or current context could make them work.

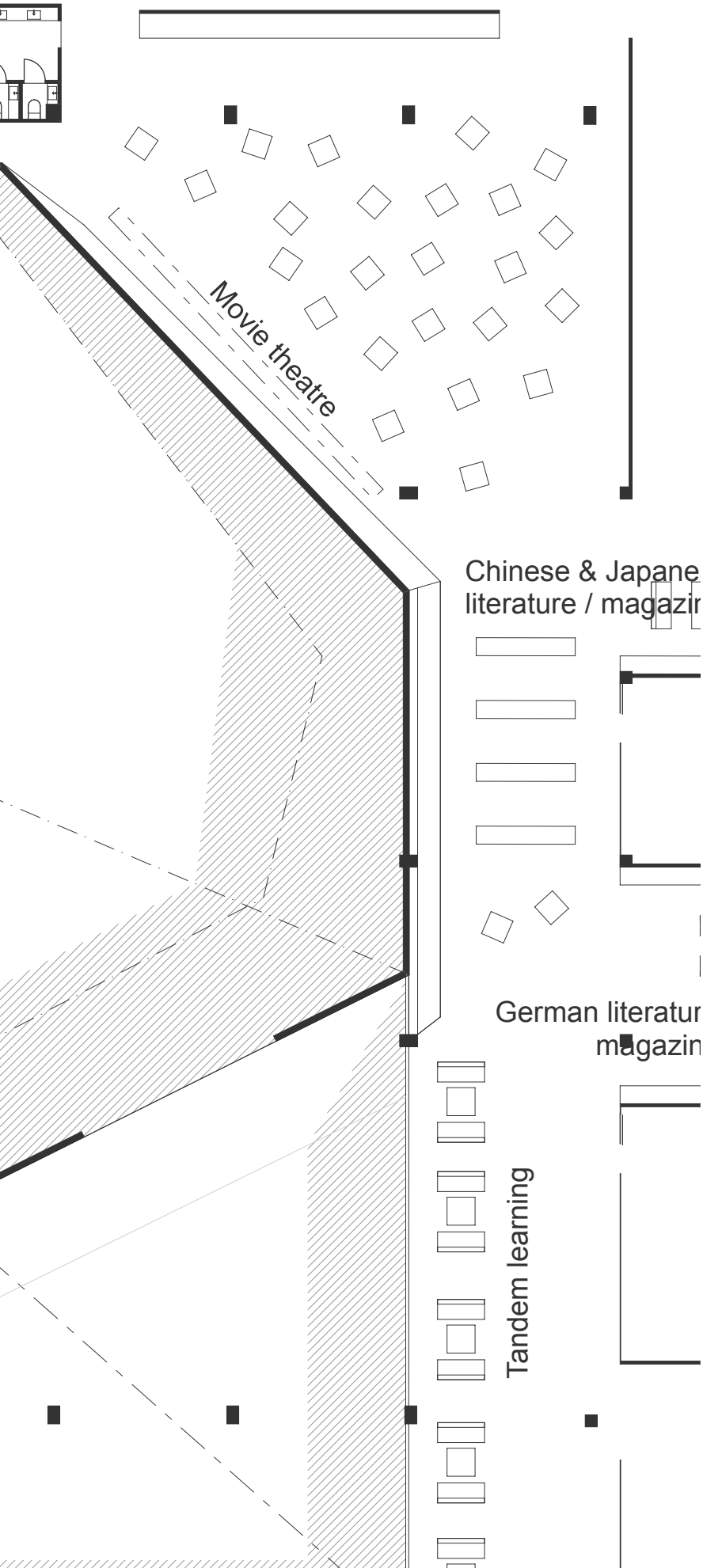


-1st Floor (street level) 1:500


Russian literature / magazines
Hinduism
Islam
Buddishm
Non-religious
Shintoism
Lecture
French literature / magazines
Lecture
Remote classroom
Garden
INTO - office & clubroom

INTERNATIONALIZTION

2nd floor



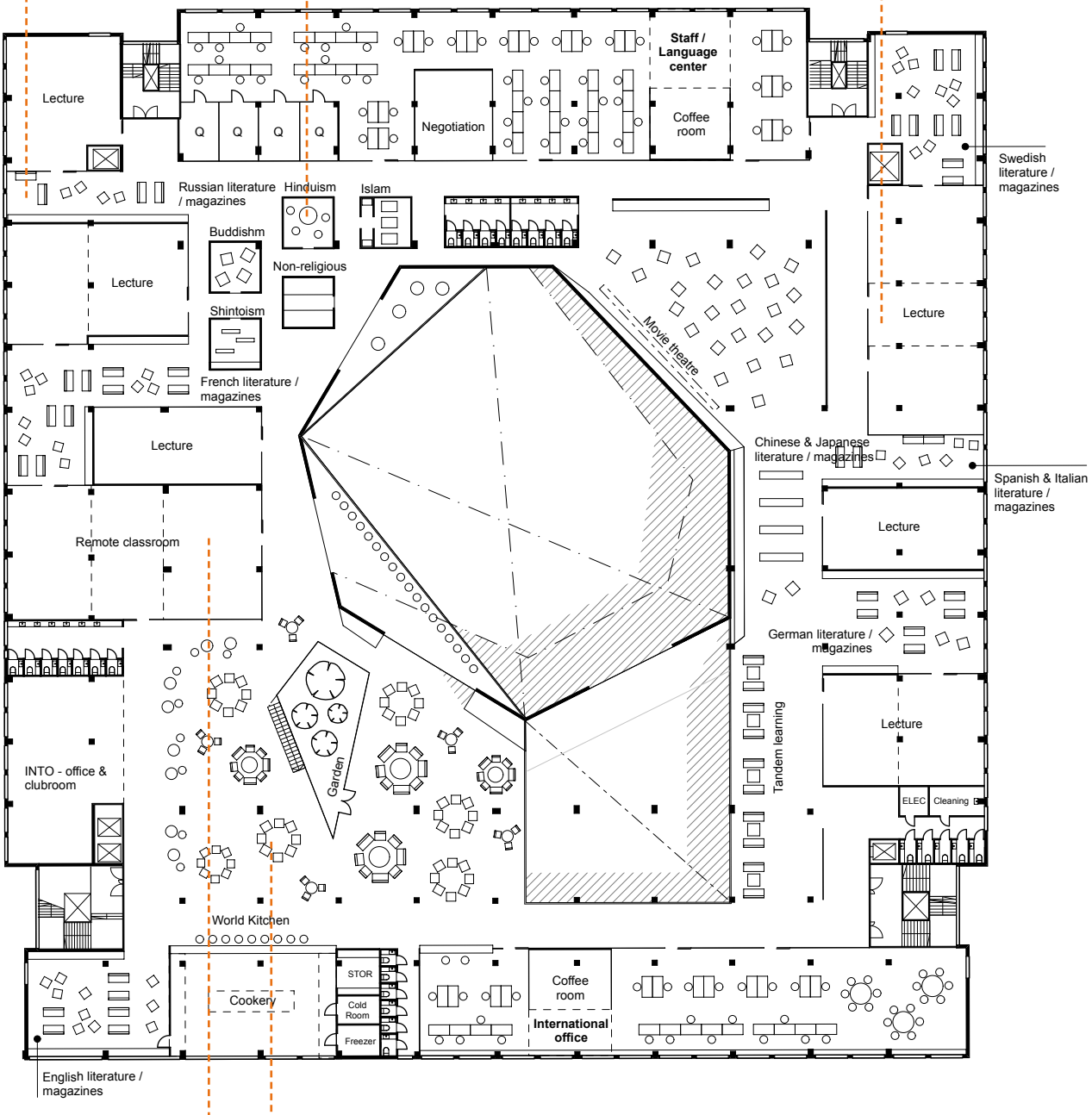
A floor plan fragment
1:200

Language specific libraries encourage students to use languages and offer internationals reading material in their own language

RELIGIOUS NOOKS

Religion has a great importance in many cultures, and an appropriate place to calm down can be hard to find in the university. These small nooks present different religion cultures and act as familiar places to take a breather in strange culture.

Lecture rooms are divisible according to different group sizes



REMOTE CLASSROOM

Virtual lectures and group exercises with world universities can be arranged in the remote classroom.

INTERNATIONAL LIVING ROOM & WORLD KITCHEN

This area acts as a common dining area and an extension of INTO's international club room. Festive occasions and tutor meetings can also be arranged here. The World Kitchen answers to the needs of different food cultures and it's free to use by students and staff.

P

2nd floor
plan 1:500

A floor dedicated exclusively to internationalization focuses on promoting interaction between Finnish and international people. As found out in chapter 4, people coming from different parts of the world can reinforce creative interaction substantially. Language skills and cultural knowledge are also ground tools for ***global*** interaction. At the same time, being in contact with native speakers strengthens the knowledge of languages and cultures.

The language learning centre that is responsible for language education of all the students in TUT, is already situated in a part of the second floor. However, in the design it is extended to cover the whole floor by combining it with functions for TUT's internationals; ***International Office*** (1)***, INTO,*** the club of international students (2), and other targeted activities. The design brings thus all the ***international functions*** of the campus ***together*** in order to benefit from their reciprocal interaction.

ACTIVE
LANGUAGE LEARNING

The renewed environment for language learning aims at expanding outside of lecture rooms. Reading foreign ***literature***, browsing ***magazines***, watching foreign ***movies*** and having real interaction with native speakers are known as efficient ways to learn languages and evoke ***intrinsic motivation*** to improve language and cultural skills.

Movies are powerful and yet entertaining source of foreign vocabulary. Towards the wall of the Forum of Inspiration there is a small ***Movie theatre*** (3) for either guided or independent film experiences. ***Language-specific libraries*** (4) serve for both the language learning of Finnish people, and the internationals by providing them with familiar reading. The movie theatre and libraries are also possible points of encounter for people that share parallel cultural interests.

Traditional ***lecture rooms*** (5) are situated close to extensive language learning functions to enable their cooperative use. Natives can be invited to assist in courses and tandem rehearsals. Most of the classrooms are divisible according to alternation in group sizes, which optimizes their use. The ***remote classroom*** (6) extends the international cooperation even further. Virtual lectures, group working and global workshops with world universities promote the divergency of ideas and skills, language learning and global networking.

SUPPORTING CULTURES

To give the means for international interaction, the design aims to attract TUT's international students, teachers and researchers by providing an environment that pays attention on cultural characteristics and supports them. The floor of Internationalization aims at creating a "***home base***" where international people can feel easily familiar, and gather to share experiences with each other, while integrating with Finnish students.

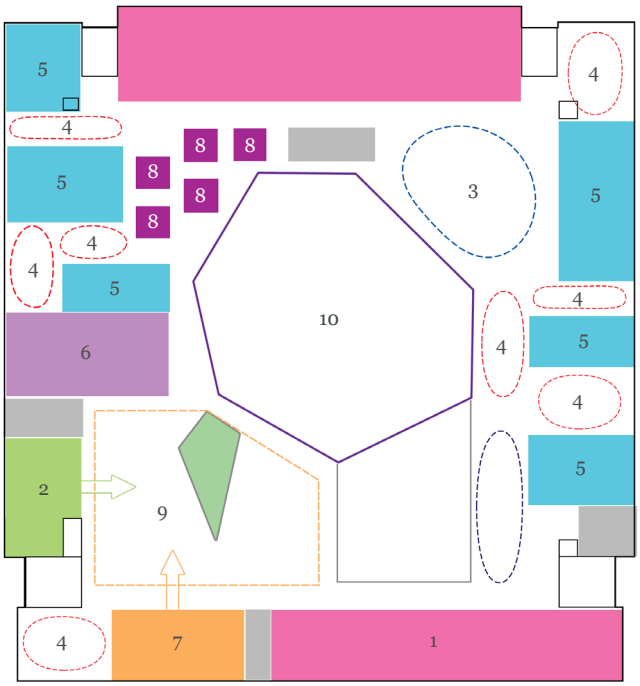
The lively international core of the floor has been formed around the first light peak garden. This large social area acts as an ***international living room*** (9), an active venue that can be used in various ways. It works as an extension for the ***club room of INTO*** (2), which can use it as a place for events such as tutor meetings or international parties. International living room is also used as a common dining area for the ***World Kitchen*** (7), that serves for international cuisine art. World Kitchen works as both a lunch restaurant and a place where international people can freely prepare dishes according to their traditions and preferences. Also demonstrative cooking performances can be held there for introducing cuisine cultures.

Religion plays a huge role in many foreign cultures, but is generally a disregarded theme in Finnish learning architecture design. Therefor, the design presents small chapel like ***nooks for religious meditation*** (8). They provide multinational people with familiar places for their religious routines. Buddhism, Hinduism, Shintoism and Islam have their own spaces since they are the biggest religions among the exchange students of TUT. There is also a nook for smaller religions and for non-religious meditation. Christianity has already a chapel elsewhere in the campus.

Both World Kitchen and Religious Nooks are ways to signal multinational people that their needs are ***considered***. The visibility of the Nooks and World Kitchen, together with multicultural lunch company, aid at deepening mere language learning into a ***wider understanding of cultures***.

Lecture rooms	835 m²	Religious nooks	72 m²
Libraries	535 m²	Movie theatre	182 m²
Language teachers	568 m²	Electrical centre	5 m²
International office	339 m²	Cleaning	10 m²
International living room	883 m²	Toilets	112,3 m²

Index:



Lecture room

Staff facilities

Religious nooks

INTO club room

World Kitchen

Garden

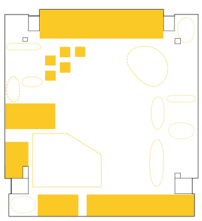
Supporting functions

Language libraries

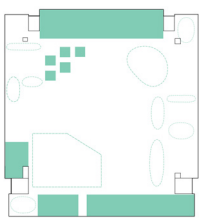
Alternative learning spaces

International living room

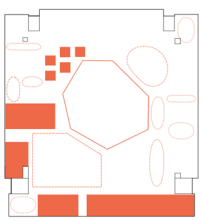
Forum of Inspiration



Openness & Diversity

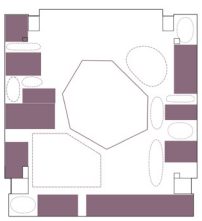


Coherent grouping

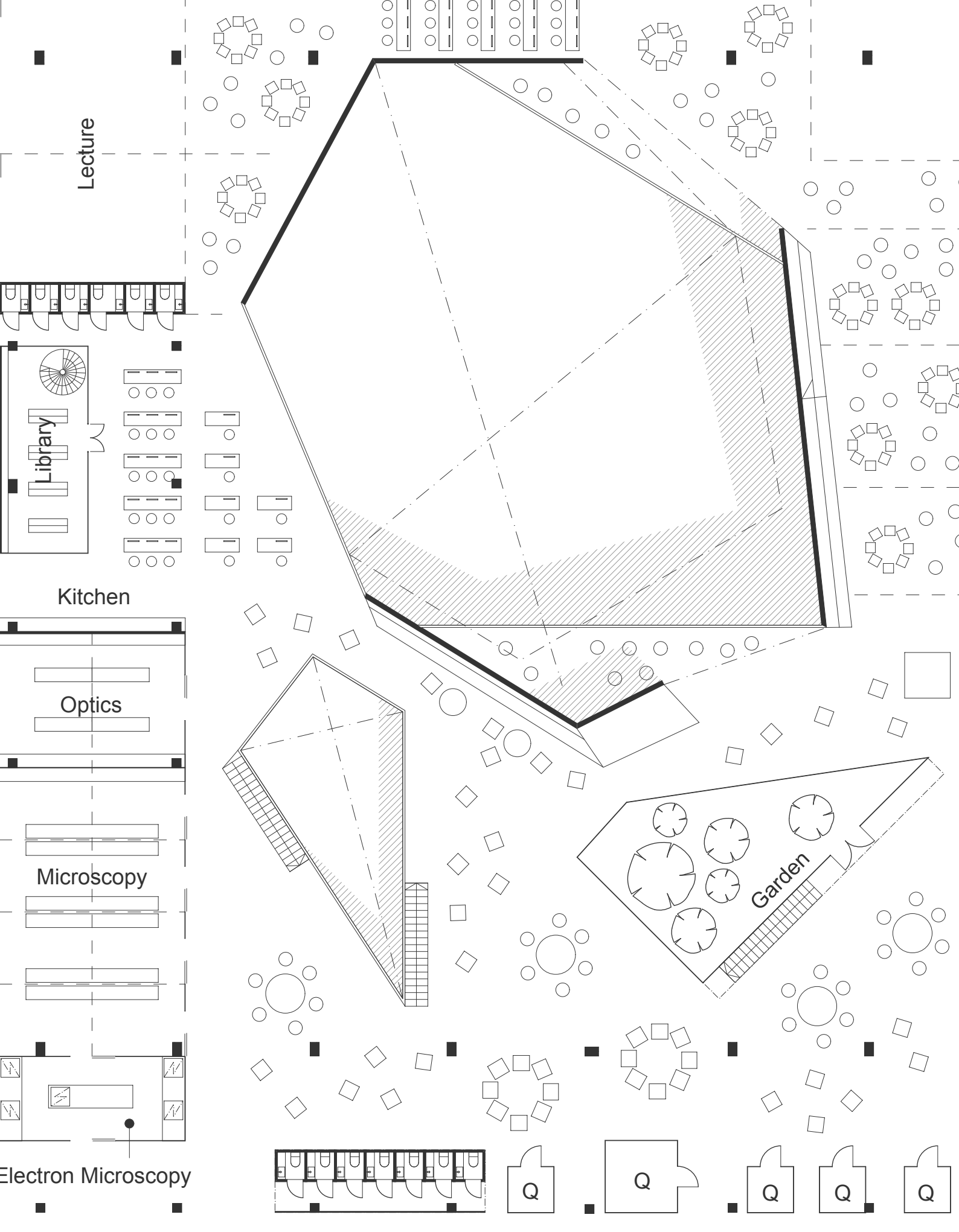


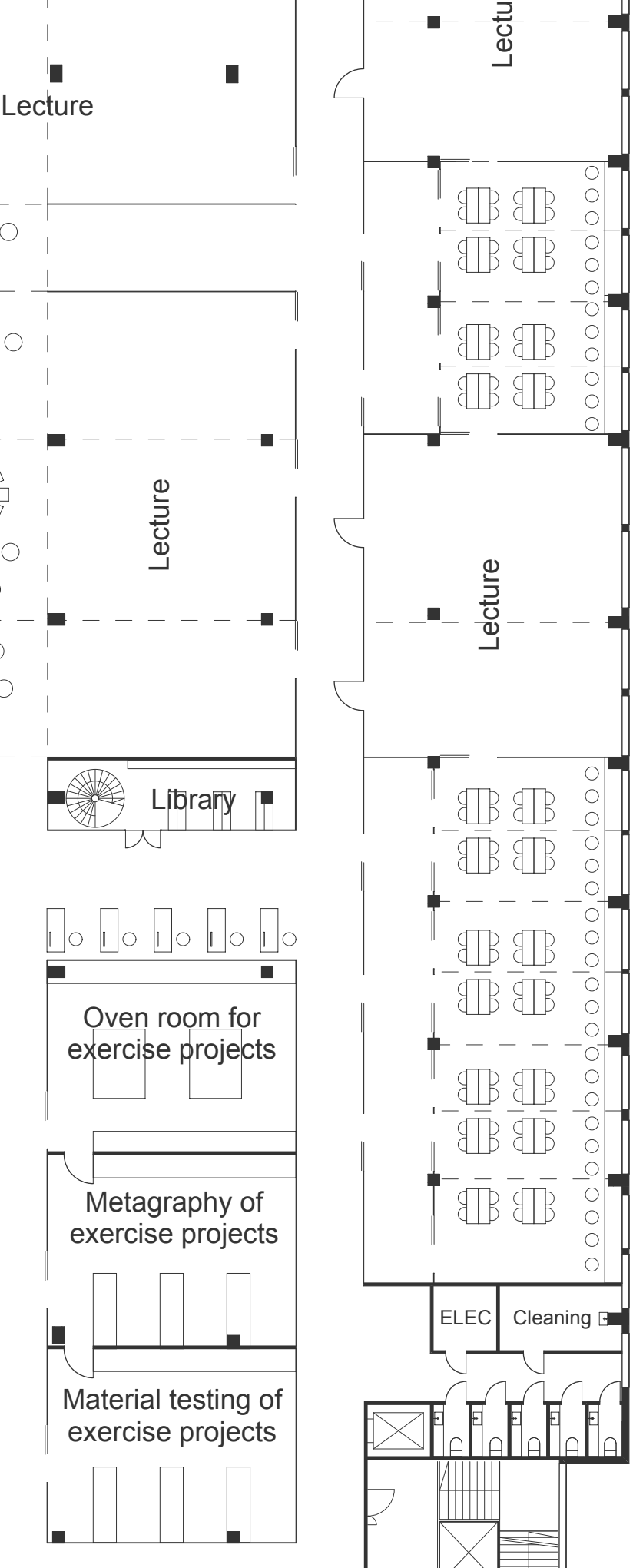
Inspiration

Work Space Variance



Means of Realization

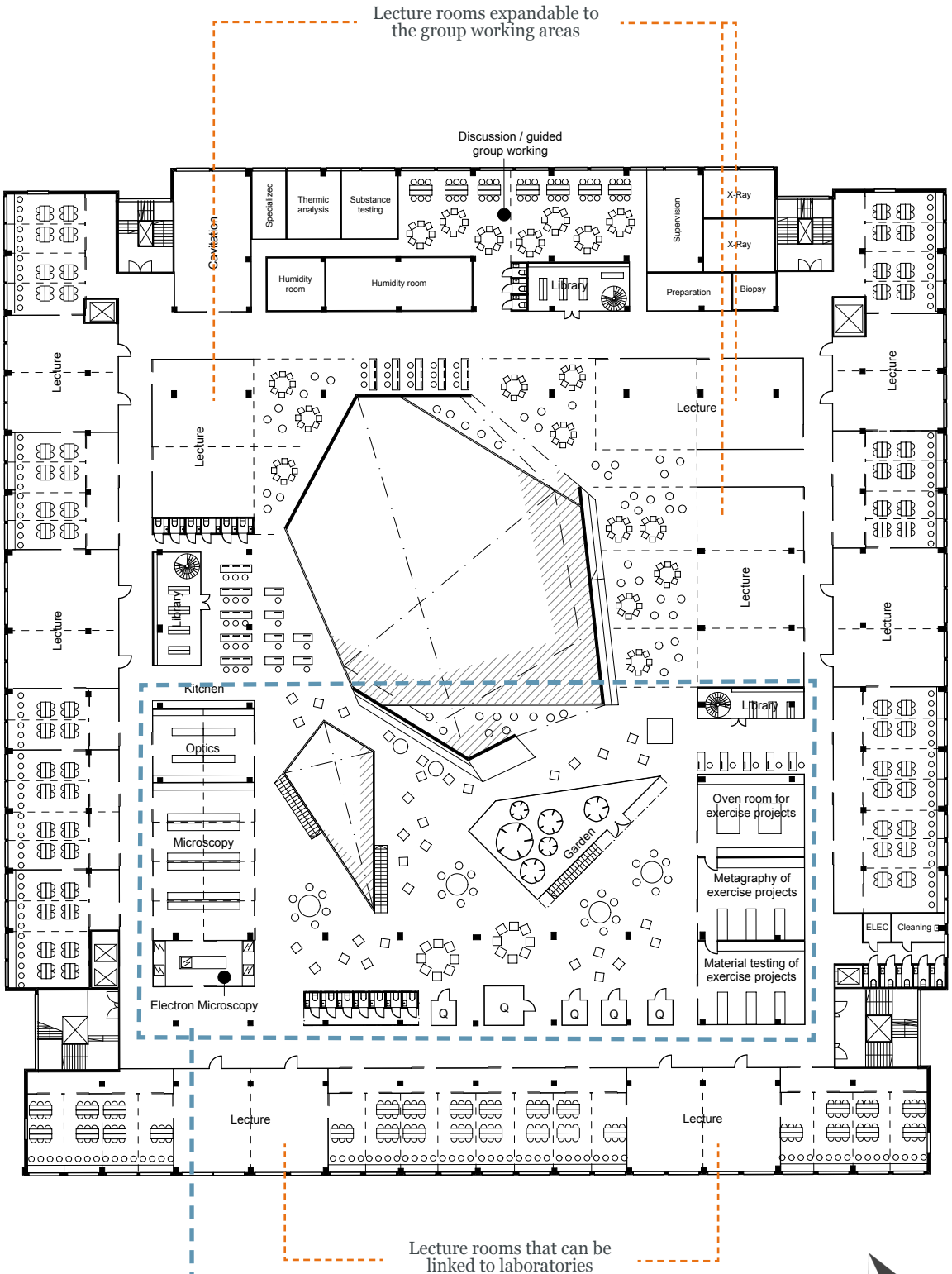

Lecture
Library
Kitchen
Optics
Microscopy
Electron Microscopy
Garden
Q
Q
Q
Q
Q



IDEA FARMING

3rd floor

A floor plan fragment
1:200



NEURAL HUB (5)

A garden-like working area surrounded by laboratories is the core of the Idea Farming level. Laboratories and other facilities are in free use for testing and developing ideas. The area is also equipped with libraries that are connected to the libraries next floor.

3rd floor
plan 1:500

In the design, all the student premises of different faculties are ***brought together***, instead of being separated to their own premises. This solution brings students, as seen each others ***peer members***, effectively together and at the same time optimizes space use. Students, being in parallel circumstances and facing same kind of tasks and questions are likely to benefit from active interaction with their peers from other disciplines. Students with different backgrounds and approaches bring ***divergent associations*** to the interaction, which promotes the chance for new ideas and innovations. ***Interdisciplinary networks*** formed in that way can also act as important resources in later working life.

The Idea Farming floor is for studying and elaboration of ideas. The design sees learning as an inventive and creative process that is driven by students' individual interest and research. This approach aims at helping students to find their ***personal capacities***, maximizing then the intrinsic motivation for learning. Learning is guided by ***problem-based*** and ***research driven*** methods where students investigate, experiment and seek answers themselves. The role of the teachers is to support learners and mentor them by helping to find meaningful research subjects.

Learning spaces are constructed of both ordinary ***lecture rooms*** (1) and spaces of ***independent research***. Lectures support learning by forming cognitive background by distribution of facts, concepts and information, whereas independent research supports insightful learning. The primal focus is in informal working spaces for groups and individuals, and in ***laboratories*** (3,6) that are flexible and in a free use for everybody.

> *"Students with different backgrounds and approaches bring **divergent associations** to the interaction*

“

The chance to experiment the facts and theories right away turns the lectures interactive

Lecture rooms (1) and ***libraries*** (2) serve especially the preparative phase of the creative process. They are places where a good knowledge base, found essential to creativity, is formed. In order to intensify traditional learning, lecture rooms are ***linked*** either to ***changeable laboratories*** (3) or ***group working areas*** (4). Testing, observation and active discussion can thus be easily included to the lectures. Experimenting the facts and theories right away turns the lectures interactive and strengthens learning experiences. Libraries extend to the upper floor and are in mutual use with the academic staff, forming vertical connections between the premises of students and staff.

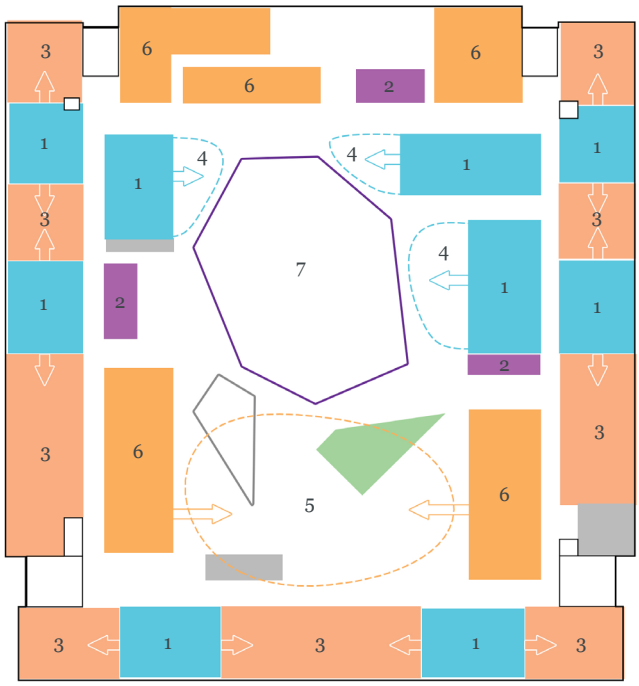
Neural Hub (5), situated around the light peaks, is where knowledge base, gathered from lectures and reading literature, can be developed further. It is a garden-like group working area surrounded by ***testing environments*** (6). This arrangement allows working to vary freely between elaboration and testing phases. Neural Hub offers premises for ***independent research and development*** of ideas. When ideas are not developed in hiding but visible to everybody, diverse ideas from diverse people have a chance to collide, and it allows the work to inspire others. The proximity of ***Forum of Inspiration*** (7) provides spontaneous stimuli or occasional ***detaching*** from intensive work.

Learning situations may vary among user preferences, group sizes and teaching methods so the system has to ***enable change***. Lecture rooms and laboratories are scalable in size, and enable multiuse. Neural Hub area allows full rearrangement of working facilities.

Lecture rooms	1083 m²
Laboratories	1567 m²
Storage	278 m²
Group working areas	733 m²
Libraries	85 m²

Quiet nooks	26 m²
Electrical centre	5 m²
Cleaning	10 m²
Toilets	55 m²

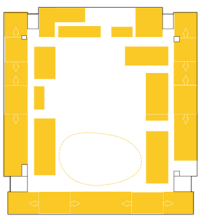
Index:



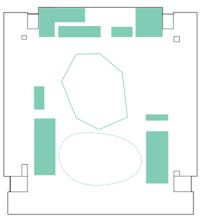
Lecture room *Flexible laboratory* *Special laboratory*

Library *Garden* *Supporting facilities*

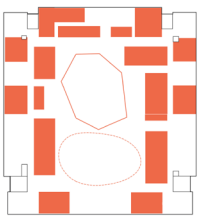
Group working area *Neural Hub area* *Forum of Inspiration*



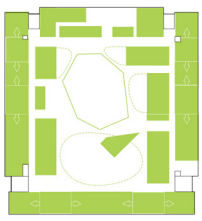
Openness & Diversity



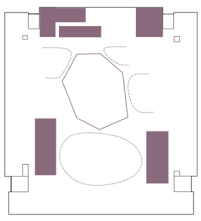
Coherent grouping



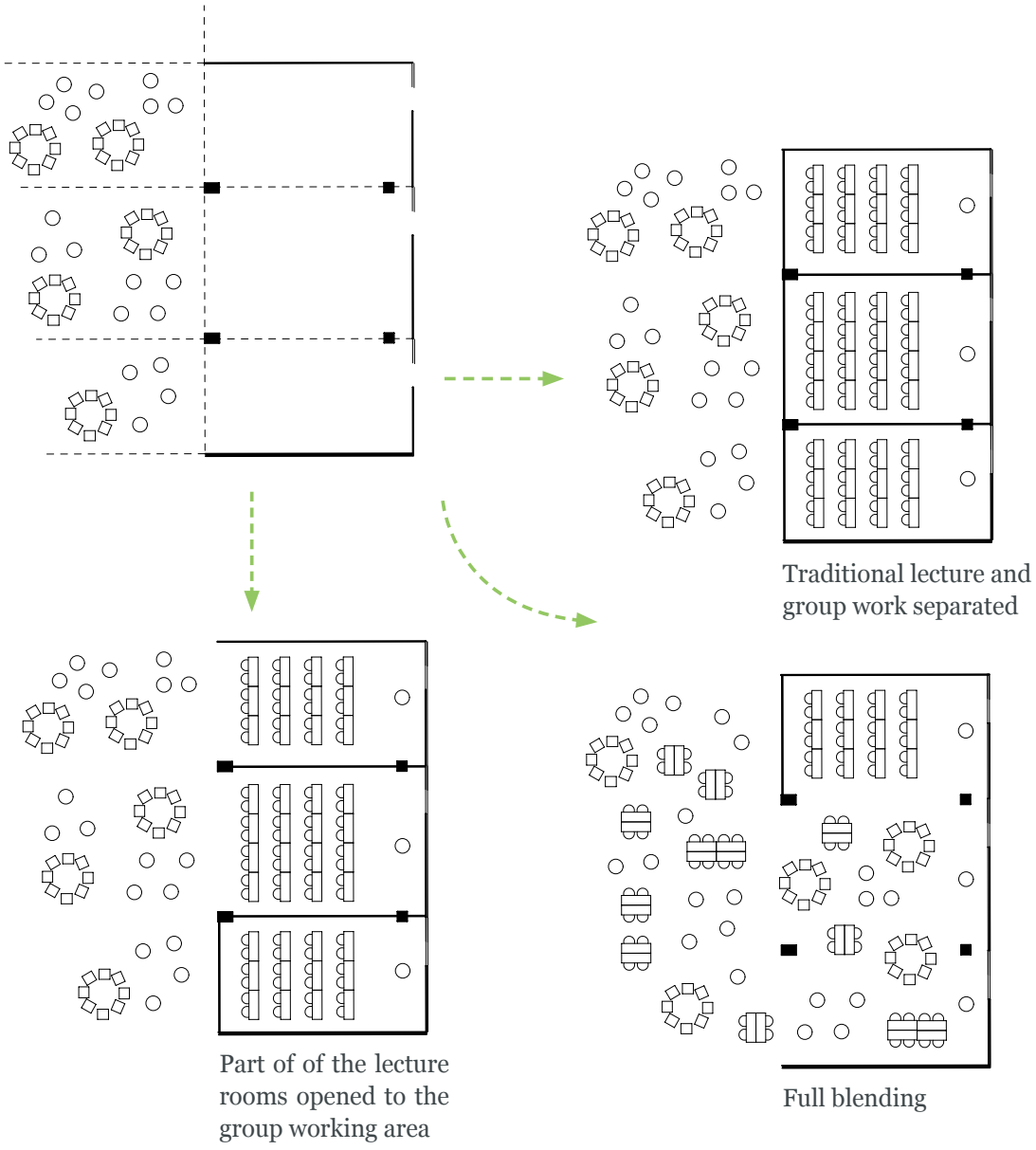
Inspiration



Work Space Variance

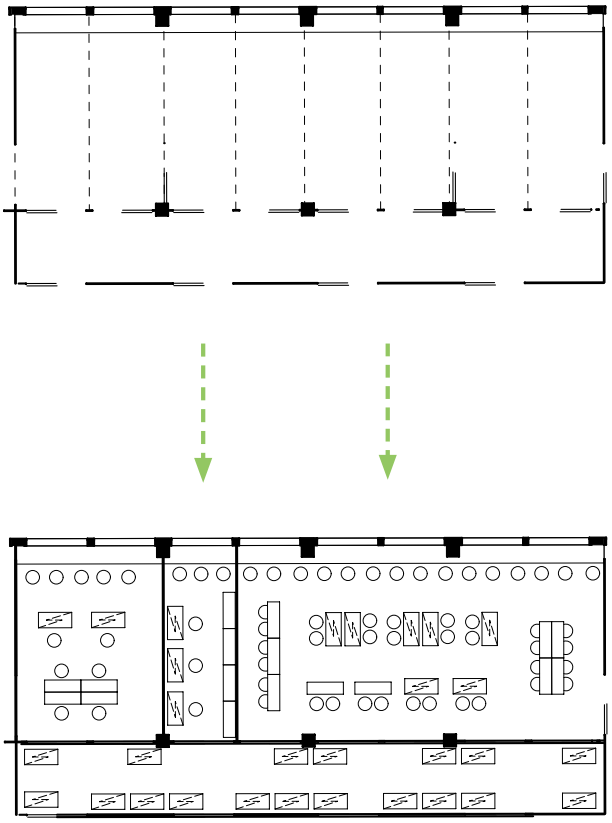


Means of Realization



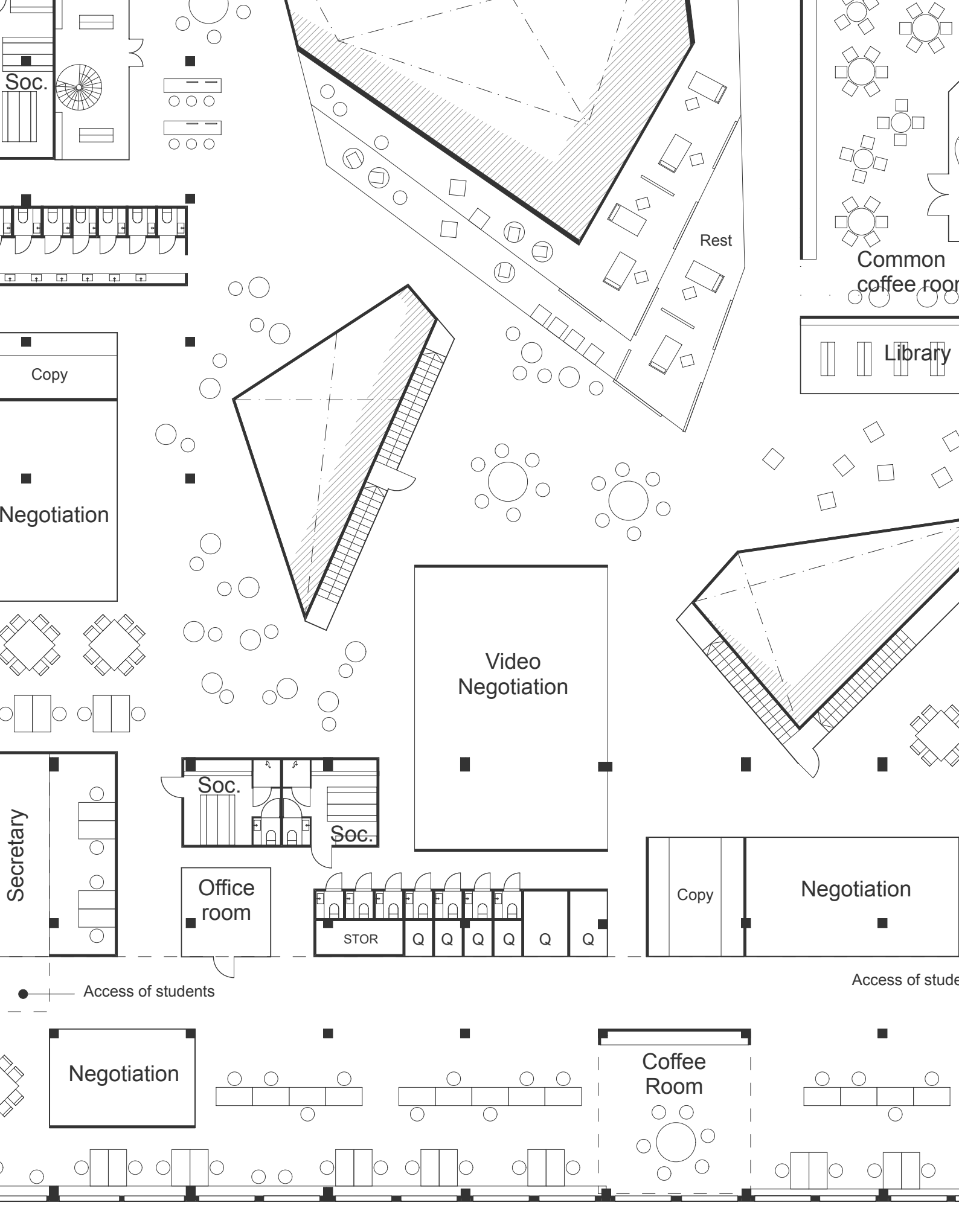
Interactive lecture rooms (1)

Lectures get new activeness when they are connected with either laboratories or group working spaces. This is how a lecture can include both theoretical and practical activity. When learned information is used immediately, learning gets more efficient.



Changeable laboratory (3)

Laboratories take a big share of TUT's facilities (Keskinen 2013). The designed new laboratory premises support flexible space use. Lecturer or students can allocate as much space as they need from the laboratory sector, and close it with sliding wall panels if they wish. Discipline specific equipment is stored in a storage zone, where they can be brought inside the laboratory zone for the time of use.


Soc.
Rest
Common
coffee room
Library
Copy
Negotiation
Video
Negotiation
Secretary
Soc.
Soc.
Office
room
STOR
Q
Q
Q
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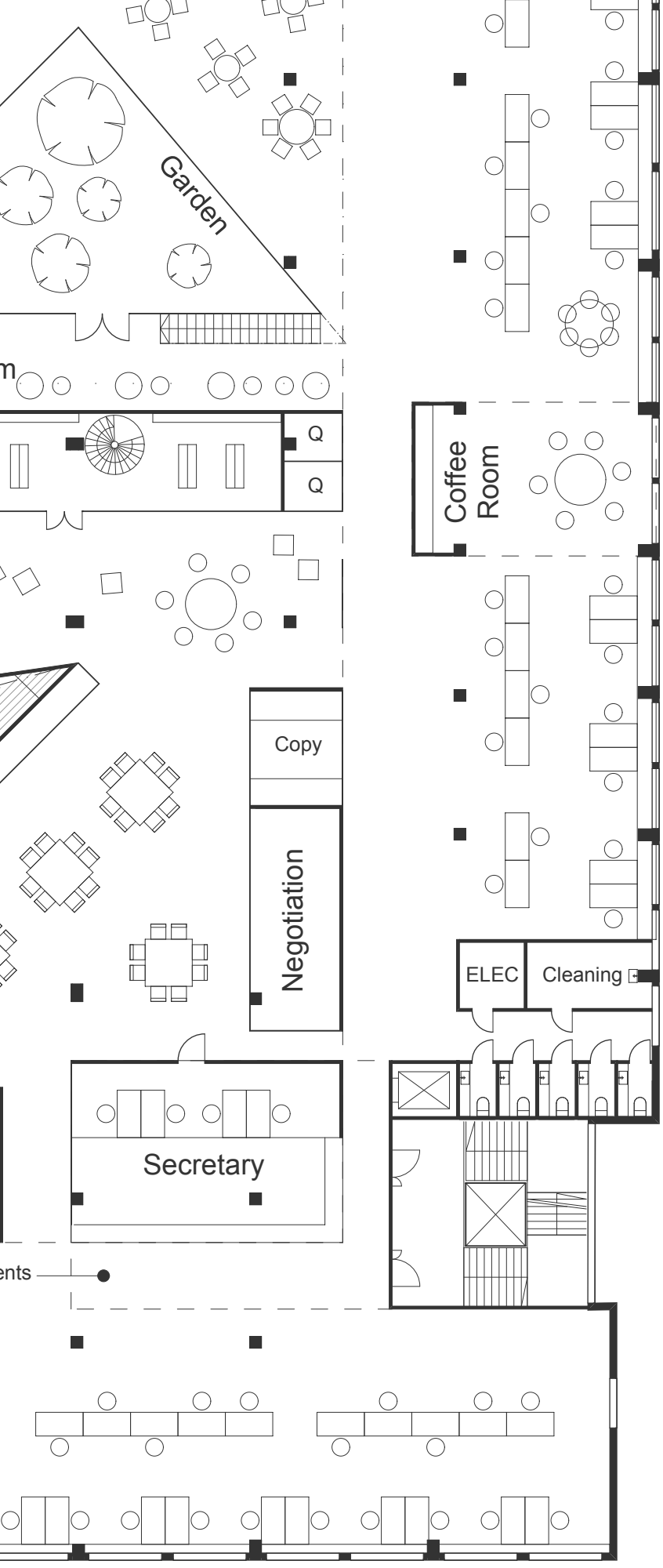
Q
Q
Copy
Negotiation
Access of students
Access of stude
Negotiation
Coffee
Room



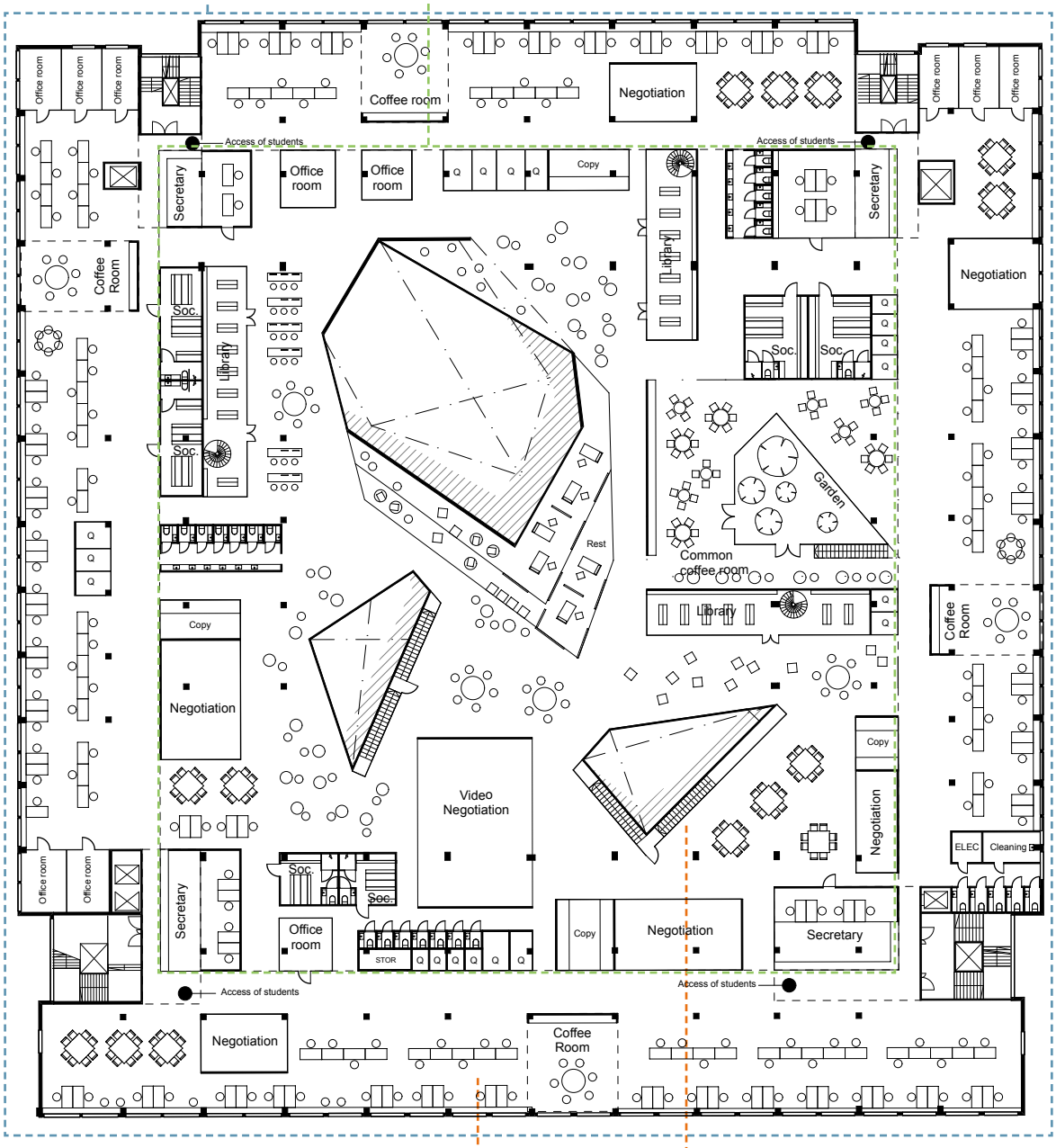
PROFESSIONAL
CORE

4th floor

A floor plan fragment
1:200

Faculty specific workspaces are situated on the outbound of the floor plan

The core area is where teachers and researchers, professors and post-graduated students from different expertise fields work together. The core area is open and its spaces can be freely rearranged according current group sizes, compositions and work methods.



SHARED WORKSPACE

Providing the employee with many alternative work places gets possible when personal office rooms are replaced with open plan workspaces. By moving to the core area, the user can easily change his work environment to suit his current needs.

Stairs take to the roof when in need for a rest

P

3rd floor
plan 1:500

The academic staff forms the core of university's research and teaching talent. The interaction with the students from the same faculty is born naturally in teaching and leisure events, but the staff from other faculties remains often unfamiliar. However, getting divergent ideas and new usable approaches from ***familiarizing with the work of their colleagues*** is essential for effective creative processes of the staff as well. That's why the accommodation for the academic staff of Konetalo is ***centralized together***. It is situated in the top floor away from spontaneous passers-by and fuss to ensure ***uninterrupted research work***. Students have only limited access in restricted areas.

The character of academic work is ***mobile and flexible***. Work is done in classrooms, office spaces, on the road or at home, full-time or temporarily. Work consists of myriad types such as teaching, writing, reading, collaboration between different people, meetings and reflection.

The use of traditional ***individual office rooms*** can thus be scant and result to inefficient space use. In addition, an individual office room enables just one kind of way of working, which doesn't suit the idea of the variety of creative work methods. Yet still, people seem to prefer them for their privacy value. Maybe the users would adopt the idea of shared work spaces more easily, if they felt that the new arrangement gives them a lot ***more possibilities*** than an individual room?

> *"A traditional, individual office room enables just one kind of way of working, which isn't favourable to support the variety of work methods of creative work.*

> *The objective is to offer the employee **a variety of possible workspaces** instead of one fixed office room*

In the design, the ***faculty specific workspaces*** (1) are located at the outbound of the floor. The core area is turned into a common ***garden-like working and leisure centre*** (2) where researchers and teachers from various professional fields can meet and cooperate. The objective is to ***offer the employee many possible varying working places*** instead of one fixed office room.

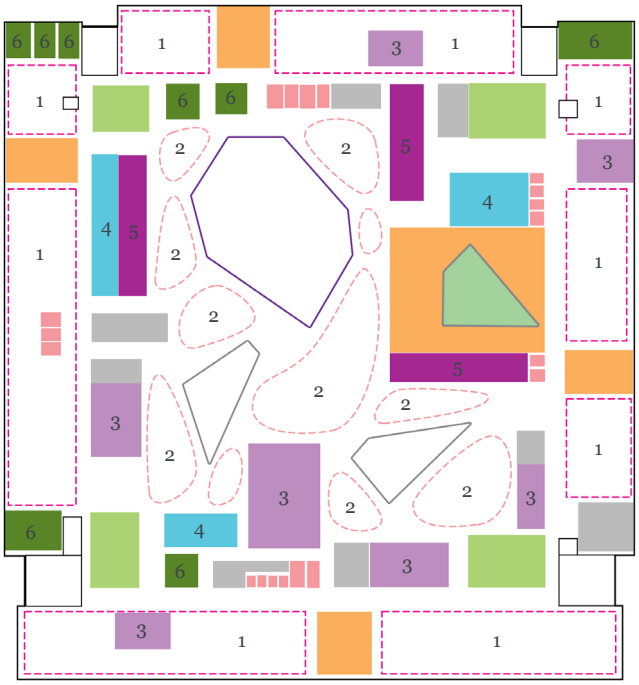
The new work spaces offer diverse options for different kinds of working, such as group work, isolated individual work or relaxed reading of books. The individual can thus ***freely choose and change*** the working space according to methods and group compositions that suit for his current nature of work. Cooperation with other faculty members is easy as every faculty has equally easy access to the central area.

The required privacy is created by delineating the central space from periphery with cellular spaces such as ***negotiation rooms*** (3), small ***quiet work nook*** spaces, ***social facilities*** (4) and ***libraries*** (5). Some single working rooms (6) are also provided for temporary use or for administrative personnel.

Faculty specific office spaces	2116,7 m²
Individual office rooms	125 m²
Quiet nooks	72 m²
Negotiation rooms	313 m²
Faculty specific coffee rooms	177 m²
Common coffee room	220 m²
Libraries	160 m²

Secretary offices	195 m²
Copy rooms	68 m²
Social facilities	136 m²
Cleaning	10 m²
Electrical centre	5 m²
Toilets	87 m²

Index:



Faculty-specific workspaces

Common workspaces

Single office rooms

Quiet work nooks

Coffee rooms

Negotiation rooms

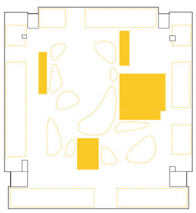
Secretary office

Library

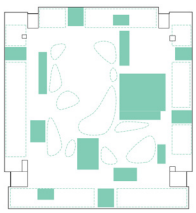
Social facilities

Supporting functions

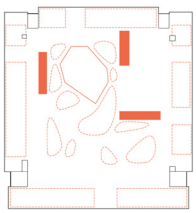
Forum of Inspiration



Openness & Diversity

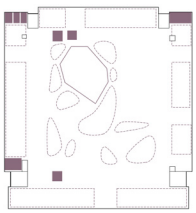


Coherent grouping



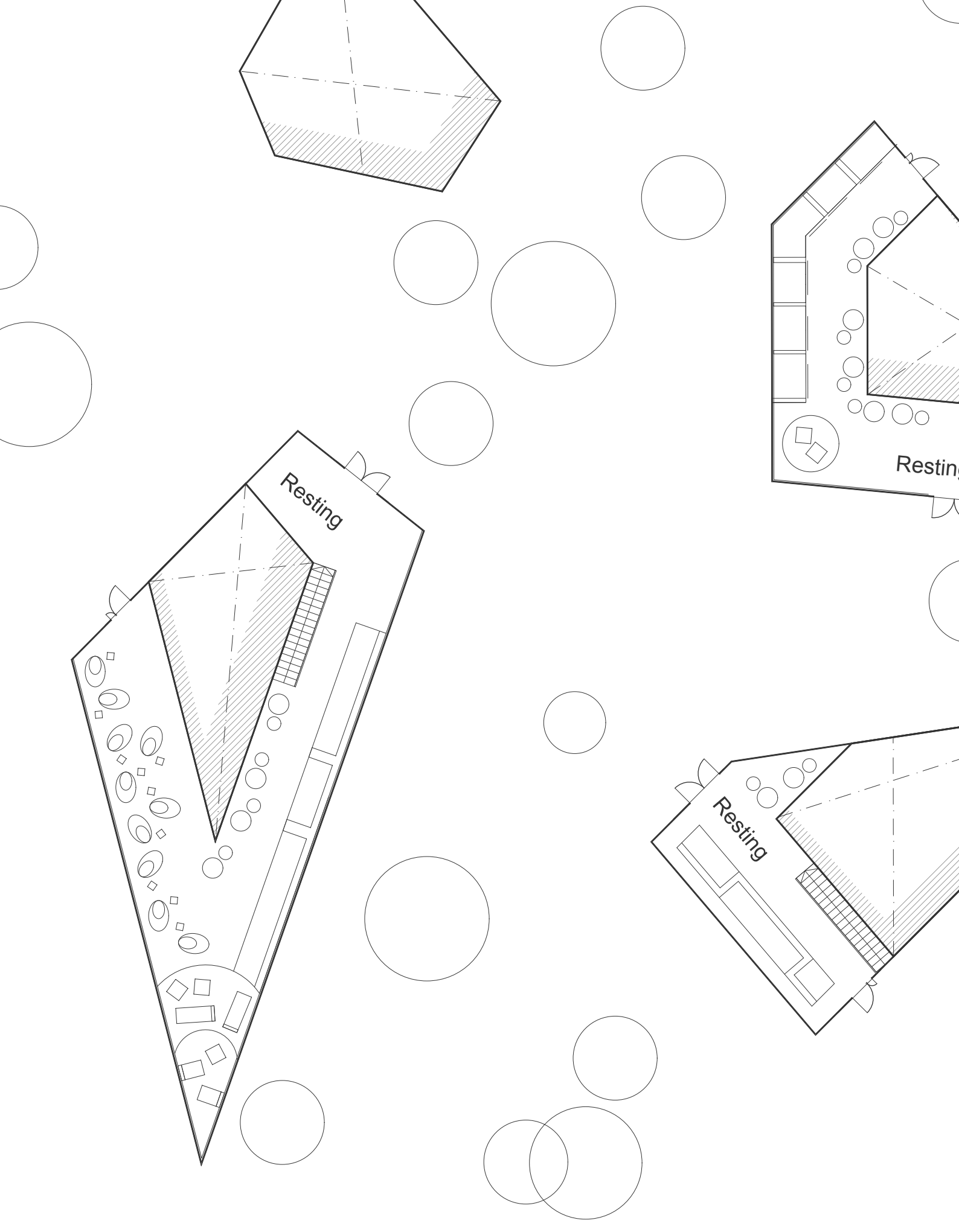
Inspiration

Work Space Variance



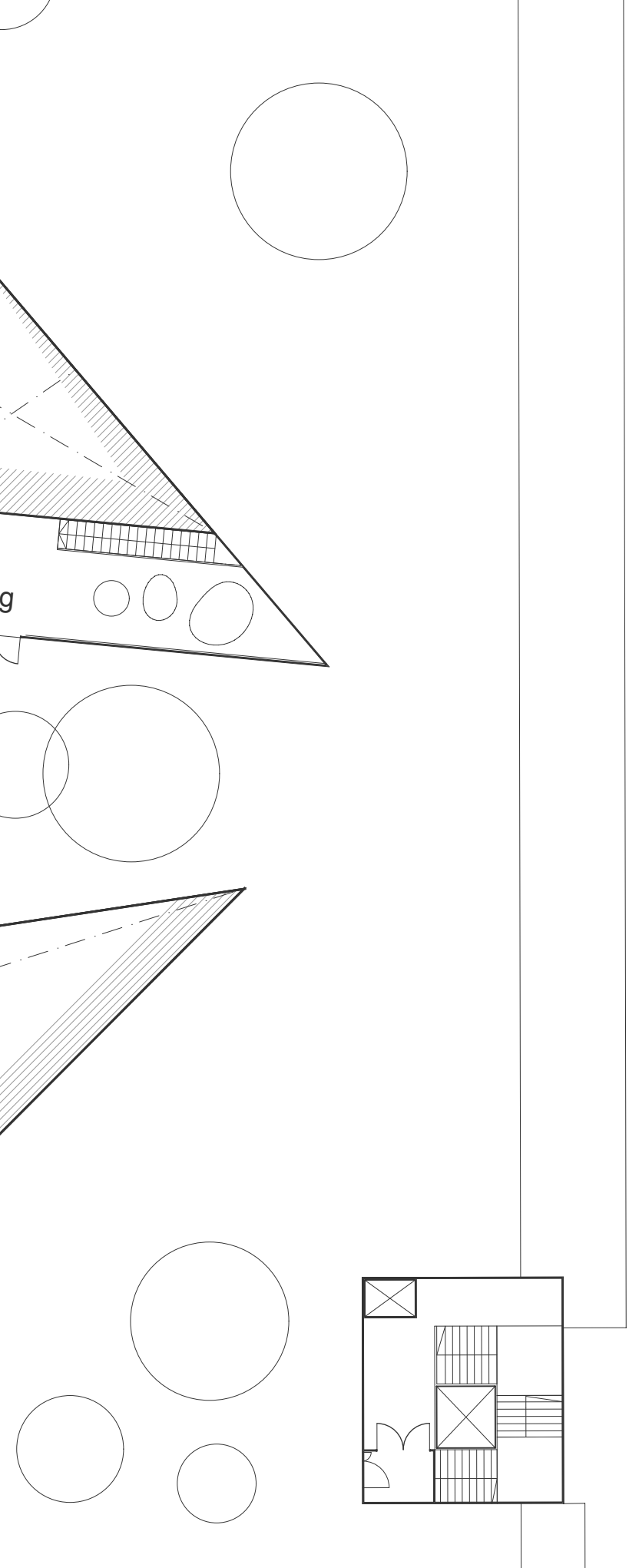
Means of Realization

University staff's working & leisure garden


Resting
Resting
Resting

ZEN AGAIN

5th floor

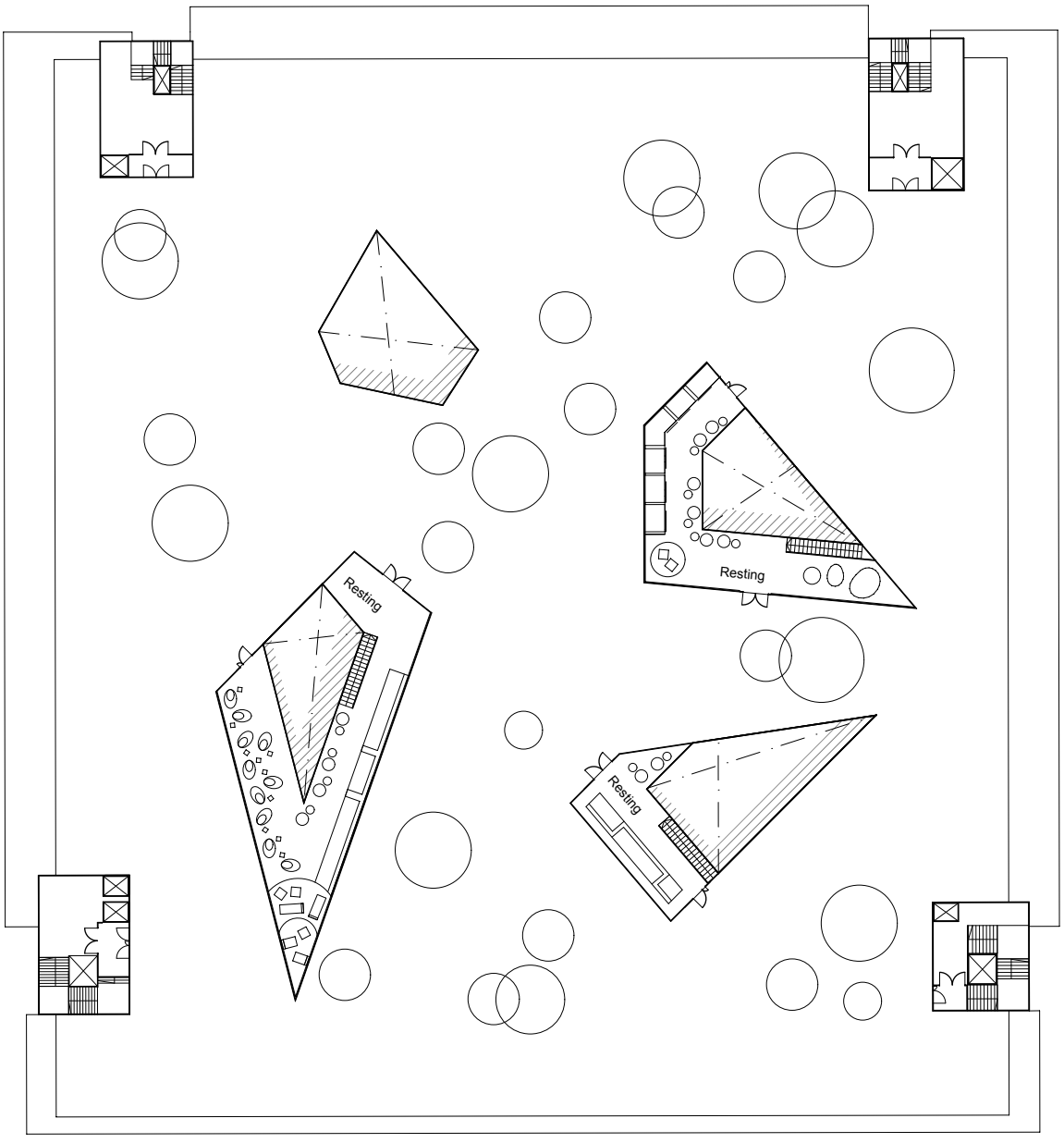


A floor plan fragment
1:200

As pointed out, intensive and engrossing work requires pure ***rest*** as a counterbalance for the mind so that it will be ready again to adopt and develop new knowledge. As learned, when the brain is not occupied with other things to do, the whole thinking capacity is freed for the ***subconscious***.

Roof level is dedicated to sleep, relaxation and work that requires silence. Connected to light peaks, the resting places can be entered by stairs from all four levels beneath them. The roof surface is turned into a calming and recreative ***nature meadow***.

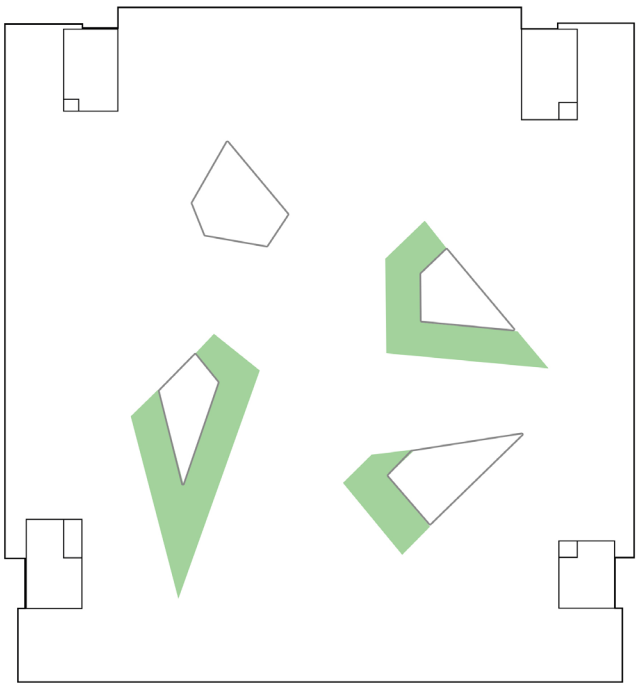
Resting places	355 m²



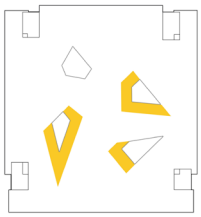
P

The roof
plan 1:500

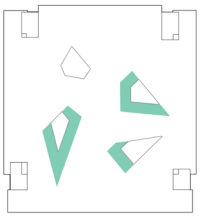
Index:



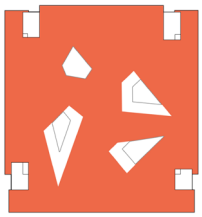
Resting place



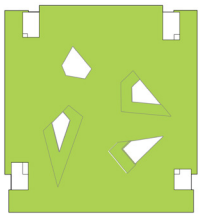
Openness & Diversity



Coherent grouping

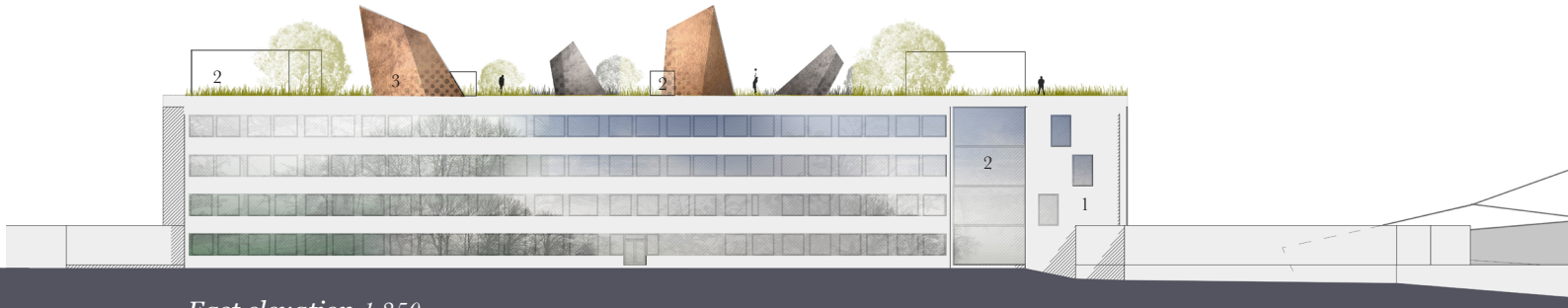


Inspiration

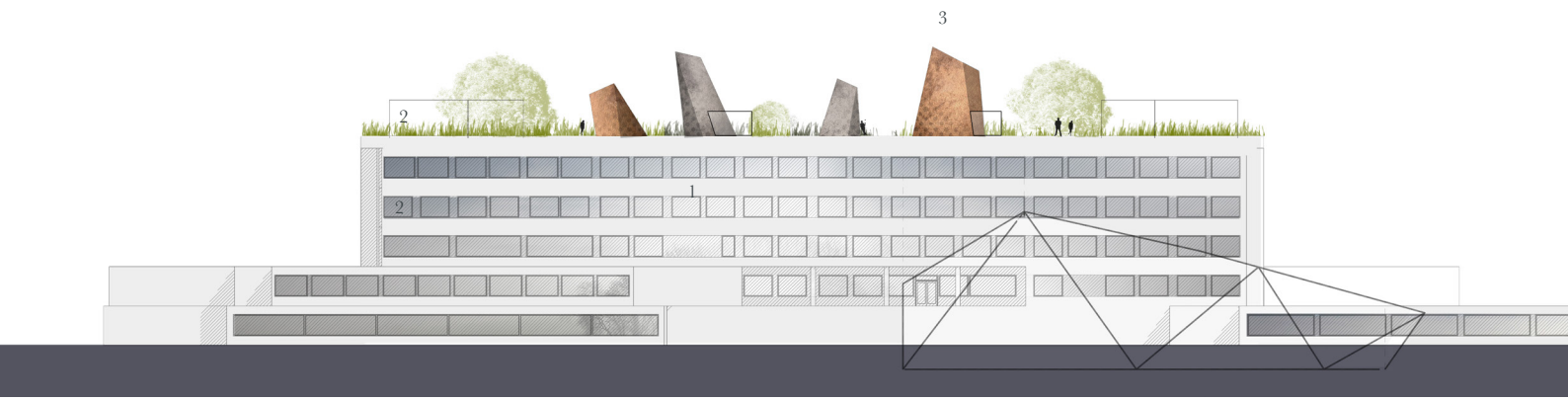


Work Space Variance

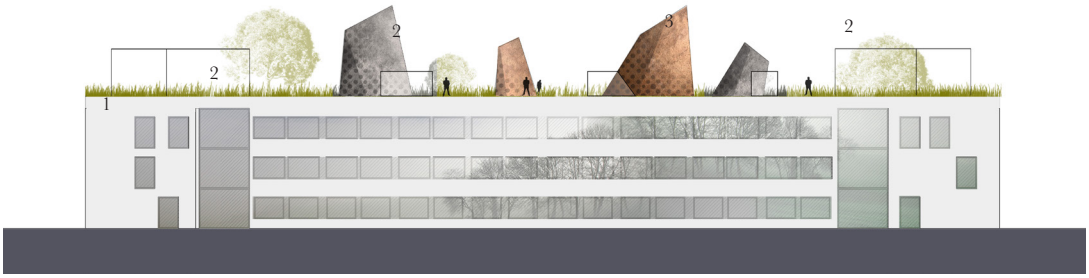
ELEVATIONS



East elevation 1:250

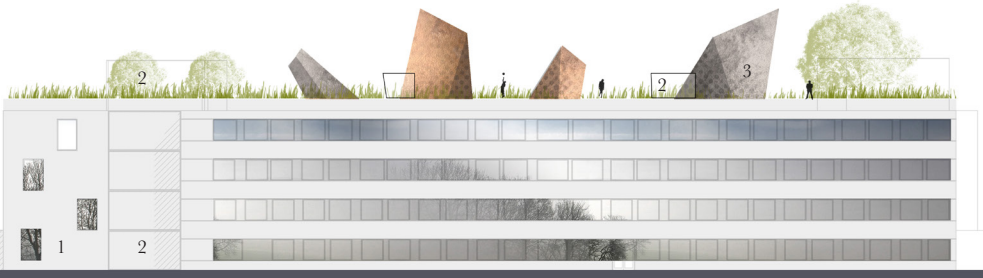


North elevation 1:250



South elevation 1:250

Materials:
1) Concrete, gray, finely washed (original)
2) Glass, clear
3) Wood, partly perforated



West elevation 1:250

6 Discussion & CONCLUSIONS

It is the time for conclusions. This chapter ends the study by gathering its main message and suggesting subjects for further investigations.

Creativity is a challenging, complicated and strongly interdisciplinary research subject. However, it seems to be a subject of increasing importance in the modern society. It is recognized as a vital character of top universities, as a key factor for the success in knowledge driven economy and an initiator of regional, national and global economic growth. Creativity and the new orientations in learning methods have a lot in common. Creativity has recently become a desired value in designing and renovating schools, universities and offices. Therefor, it is surprising that systematic research on the relation between creativity and physical environment is so scarce. Plenty of designs that aim at increasing creativity have been made, but remain mainly as interpretations of their designers' assumptions.

Although creativity is mental activity, the mind is always affected by the surroundings of the body. It is thus probable that qualities of physical environment *can* increase or decrease creativity. This study has been an attempt to find some accurate knowledge to guide architectural design. This has been done by approaching the subject from the research of creativity itself. The research history of creativity has proven to be long and wide, and from there this study has lifted up facts that could be useful for architectural design.

This study has presented my vision of a design concept that aims to promote creativity in learning environment. The concept has been set to the form of five design principles. These are Openness & Diversity, Coherent Grouping, Inspiration, Work Space Variance and Means of Realization.

The first principle, *Openness & Diversity* proposes means for clustering a large number and variety of people from different backgrounds, hence providing a great quantity of divergent associations for divergent thinking. *Coherent Grouping* introduces means on how to drive together people who could benefit from each other in terms of creativity. The aim of this is to assist in forming intellectual networks. The principle of *Inspiration* refers to ways of making the environment a strong source of inspirational stimuli that evokes intrinsic motivation and desire to work creatively. The principle of *Work Space Variance* introduces types of space that could support the special nature of creative work. Last, *Means of Realization* points out possible spaces and functions that could support the elaboration of ideas and enable their development into innovations.

To visualize the concept, I have introduced a design case where these principles are examined to the level of actual design solutions. For *Openness & Diversity*, the design case presents spaces that aim at attracting people actively from diverse backgrounds; from campus and businesses, from different expertise fields and levels, from diverse cultures and with different lifestyles. These include for example spaces for sports or other kind of active recreation, theme restaurants and facilities for interdisciplinary research. *Coherent Grouping* is supported in several ways, for example by rearranging functions according to floors; for example all of the facilities for students are on one floor, and the facilities of university staff on another. When spaces are regrouped this way, the users are close to their peers, with whom they are likely to get in contact with beneficial associations, new approaches and relevant viewpoints. In addition, space functions that inherently attract people with same interests, such as student clubs, are provided in appropriate floors.

In the design case, the most visible sign of the principle of *Inspiration* is the Forum of Inspiration, a venue where inspiring thinkers and for example quest lecturers can introduce inspiring subjects and transmit their exhilaration to the audience. The events of Forum of Inspiration can be spontaneously participated and followed from any of the floors, since this voluminous speech hall stretches through the whole building, forming the actual core of every floor. The principle of *Work Space Variance* is visible in the design through specially designed spaces for creative work. For example places for resting and active detaching aim at supporting the subconscious phases of the creative process, whereas garden-like work and leisure areas support the serendipitous encounters of ideas from various sources. The principle of *Means of Realization* can be seen most visibly in the design's annex part, to which free office facilities has been created for the further development of most successful ideas. Also laboratories and facilities for group work, that are in the free use of students, support the independent elaboration of ideas.

Undeniably, the design case presents only a few limited ways of applying the concept. Many questions arise on their accuracy; would changeable laboratories actually work in real life, or are the functions in the 2nd floor even able to support cultural needs? Many things would have been made differently, possibly with better results. Current trends on university design, or for example the values that University Properties of Finland Ltd represent, have naturally have their influence on the selection of solutions.

For example, does the fact that the academic staff, working together in the same floor, has the *opportunity* to change viewpoints and approaches really make a sufficient precondition for enabling the creative interaction? Should the arrangement be even more directive, for example by abandoning the idea of faculty specific workspaces and by forming wholly interdisciplinary working units of professors, researchers and secretaries? However, my impression of the importance of internal interaction of the faculties, for example in administrative or practical matters, led me to the presented solution.

The same hesitation applies for example to my decision to use open plan work spaces and offices. Among their advantages for free flow of people and their encounters, they have disadvantages too; increased noise and visual distractions, or reduced possibilities for private or confidential conversations. It would be interesting to explore also the possibilities of using cellular, private workspaces. One possibility would be for example a solution where cellular workspaces would be situated in hoops, with common, interdisciplinary working and leisure areas in the middle. However, this solution would increase the space need, which might be against the current space management policy in many universities.

The concept and the five principles were created for university environment design. The concept and presented design solutions could possibly be applied to the design of the universities of applied studies as well, as their activities are somewhat similar. From certain viewpoints, they could also be used in designing office environments for large organizations.

The concept, the design principles and their applications are entirely based on my own understanding on the ways that the found elements of creativity could be supported by architectural design. However, in order to achieve reliable evidence for their effectiveness they should be experimented, which would be a natural subject for further investigations.

Because of the limited time frame of a Master's thesis, the subject was examined in a big scale of a building, focusing on possible space types and their organization. An important subject for further research would be for example to investigate the impact that an individual space has on creativity. Also the impact of architectural form, which is here examined only through my own assumptions, would be a fertile subject for research.

If aiming to develop a world-scale creative university that would parent the great innovational talents of tomorrow and cultivate the economic growth around itself, it is obvious that mere qualified architectural design is not enough. It is always people, their efforts and their way of use that make architecture what it is and what it can be.

Above all, enabling creativity for university education would require changes in attitudes and goal settings. For example taking incubation as a part of learning methods would need a huge change in the current efficiency-accentuating climate. To flourish, creativity requires a permissive atmosphere that doesn't prevent a sudden rest-taking or playing video games when one feels like it. Beside the fact that environment can affect the production of novelty, it is also responsible for its acceptance; the concept's success depends highly on the *will of the* university to take in creative ideas and to engage in supporting their developing. Creative working methods should also be somehow taught to people so that they would be able to use their creativity supporting environment effectively.

When talking about how to set the start for a highly creative community, I want to mention one last point. Among the other features that have been introduced so far, there seems to be one more thing needed: a pioneer. In Athens, it was Sokrates, and in the case of Silicon Valley, it was Frederick Terman. A pioneer is a person or a team with a strong vision and willpower, who puts the start for the renewal and intellectual networking. Someone who is brave enough to start the change.

Bibliography &

REFERENCES

7

Aura, Seppo ; Horelli, Liisa ; Korpela, Kalevi. 1997. Ympäristöpyskologian perusteet. Porvoo, WSOY. 197 p.

Clements-Croome, Derek. 2006. Creating the Productive Workplace. 2nd edition. Oxon, Taylor & Francis. 468 p.

Collins, Randall. 2004. Interaction Ritual Chains. Princenton, Princenton University Press. 439 p.

Csikszentmihalyi. Mihaly. 1996. Creativity: Flow and the psychology of discovery and invention. New York, Harper Perennial. 456 p.

Florida, Richard, 2002. The Rise of the Creative Class. New York, Basic books. 416 p.

Florida, Richard. 2012. The Rise of the Creative Class - revisited. New York, Basic books. 2nd edition. 512 p.

Florida, Richard. http://www.creativeclass.com/_v3/whos_your_city/maps/#Innovation_in_a_Spiky_World. Retrieved 20.11.2013

Glover, John A.; Ronning, Royce R. ; Reynolds, Cecil R. 1989. Handbook of Creativity. New York, Plenum Press. 447 p.

Haefele, John W. 1962. Creativity and Innovation. New York, Reinhold publishing corporation. 306 p.

Heilman, Kenneth M. , Nadeau, Stephen E. , Beversdorf, David O. 2003. Creative Innovation: Possible Brain Mechanisms, Neurocase, 9: 5, pp. 369 — 379

Hennessey, Beth A. , Amabile, Teresa M. 2010. Creativity. Annual Review of Psychology, Vol. 61 Issue 1, pp. 569-598.

Himanen, Pekka. 2007. Suomalainen unelma: Innovaatioraportti. 2. Painos. Helsinki, Teknologiateollisuuden 100-vuotissäätiö. 160 p.

Jankowska, Maja; Atlay, Mark. 2008. Use of creative space in enhancing students' engagement. Innovations in Education and Teaching International, Vol. 45, issue 3, pp. 271-279.

Kettunen, Juha ; Kairisto-Mertanen, Liisa ; Penttilä, Taru. 2013. Innovation pedagogy and desired learning outcomes in higher education. On the horizon, Vol. 21, No. 4, pp. 333-342.

Keskinen, Sanna. 2014. Campus as a city. Master's Thesis. Tampere. Tampere University of Technology. 155 p.

Koski, Jussi. 2001. Luova hierre - näkökulmia yksilöiden, ryhmien ja organisaatioiden luovuuteen. Jyväskylä, Gummerrus Kirjapaino Oy. 243 p.

Leonard, Dorothy A. & Swap, Walter C. 1999. When Sparks fly. Boston, Harvard Business School Press. 242 p.

Lindblom-Ylänne, Sari; Nevgi, Anne. 2009. Yliopisto-opettajan käsikirja. Helsinki, WSOY pro. 439 p.

Mednick, Sarnoff A. 1962. The associative basis of the creative process. Psychological Review, Vol 69, Issue 3, pp. 220-232.

Merriam-Webster Dictionary (www). Retrieved on 19/11/2013. http://www.merriam-webster.com/dictionary

Nyström, Harry. 1979. Creativity and Innovation. Surrey, John Wiley & Sons Ltd. 125p.

Oxford English Dictionary (www). Retrieved on 19/11/2013. http://www.oxforddictionaries.com

Parking, Jennifer ; Austin, Simon ; Pinder, James ; Baguley, Thom ; Allenby, Simon. 2011. Balancing collaboration and privacy in academic workspaces. Emerald, Vol. 29, No. 1/2 pp. 31-49.

Thrash, Todd M. ; Elliot, Andrew J. 2003. Inspiration as a Psychological Construct. Journal of Personality and Social Psychology, Vol. 84, No 4, pp. 871-889

www.tut.fi. Website of Tampere University of Technology. Retrieved on 12/01/2014.

www.ttyy.fi. Website of Student Union of Tampere University of Technology. Retrieved on 12/01/2014.

Zeisel, John. 2006. Inquiry by design: Environment / Behavior / Neuroscience in Architecture, Interiors, Landscape, and Planning. New York, W.W. Norton & Company, Inc. 400 p.

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KIITOS.

Ilmari Lahdelmalle ja Jenni Poutaselle
parhaasta mahdollisesta ohjauksesta
ja tuesta kaikissa työn vaiheissa.

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Pihlajarinteelle, sekä Jaakko Lassilalle
lukemisesta, kuuntelemisesta ja
kaikesta mahdollisesta.

A small
architectural discourse on

Creativity

This study proposes a design concept to boost creativity and innovation through reshaping the architecture of learning environments. The study approaches the subject by investigating how the organization of spaces could have a real effect on the possibilities for creative learning. By five design steps, the concept aims to promote social interaction on every level, maximize the possibility to get inspired and allow the endless diversity of different working processes. The theory derives from the initiators of creativity that have been recognized in the fields of psychology, sociology and economic geography.

The study offers a fresh point of view on university design. It claims that a university building should not be thought as merely a series of enclosures that house faculties and students; but, rather treated as a dynamic interrelated network of people and ideas that are in continuous interaction.